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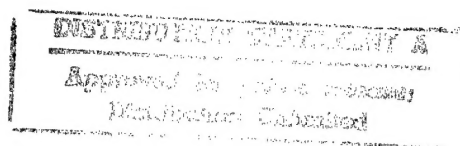
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29 October 1985

# USSR Report

MACHINE TOOLS AND METALWORKING EQUIPMENT

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29 October 1985

# USSR REPORT

## MACHINE TOOLS AND METALWORKING EQUIPMENT

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INDUSTRY PLANNING AND ECONOMICS

GOSPLAN OFFICIAL ON PRIORITIES FOR MACHINE TOOL INDUSTRY

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 6, Jun 85, pp 3-13

[Article by Professor G. Stroganov, deputy director of USSR Gosplan, doctor of technical sciences: "Towards the 27th CPSU Congress: Basic Tendencies in the Development of the Machine Tool Industry"]

[Excerpt] At the April 1985 plenum of the CPSU Central Committee, it was emphasized that "as the main strategic lever for intensification of the national economy and better use of our nation's potential, the party sees as its first priority cardinal acceleration of scientific and technical progress...What is needed are revolutionary advances such as a switch to completely new technological systems and to the latest generations of equipment that can give the utmost degree of efficiency. In essence, this is a matter of using scientific and technical achievements to re-equip all of our industries".

In the realization of this task, the leading role will be taken by the machine tool industry whose priority development and constant improvement will bring about the extensive introduction to industry of scientific and technical achievements. This should also be accompanied by an active and structured policy to create and renew our basic industrial resources aimed at saving labor, investment and material resources. In this regard, the better part of capital investments must be used not to increase the industrial apparatus but to compensate for the loss of equipment due to obsolescence and wearing out and especially the most active equipment used in basic industry and also technology.

To efficiently renew our basic industrial resources, we must introduce new high-speed machines, equipment, instruments and the newest technologies. In this regard, it would be most effective to re-equip and reconstruct industry and more than half of all capital investments must be used for this purpose.

Organic unification of scientific and technological progress with the advantages of the socialist economic system challenges us to provide: the maximum and quickest possible saturation of the economy and of material production above all with the new generation of machines, equipment, instruments and materials embodying the achievements of modern science and technology; further acceleration, expansion and intensification of their

inter-related and proportional development. Therefore science and the high-priority branches of our economy, computers and instrument building, electronics and electronic technology, the machine and tool building industries should, as catalysts of scientific and technical progress, grow at a rapid pace.

The machine tool industry has done much to raise the technical level and quality of products. A broad network of scientific establishments, science and production associations, experimental bases, design bureaus and technological design institutes has made it possible to study, develop and create the newest machinery, equipment and instruments, advanced technological processes and control systems. The planned and orderly use of all of the scientific and technical potential of the machine tool industry makes it possible to make wider use each year of science and technology and to successfully solve many complicated problems of science and industry.

From year to year, the output of advanced equipment is growing and there is increasing production of multipurpose machines and equipment, automated NC tools and machine centers. Much of this is done under international cooperation. The structure of machine production has improved and many new changes have been made to the different types of production. The unit power, output and reliability have been increased while the consumption of both materials and energy has been reduced.

The machine tools industry is working to solve such massive problems as meeting the nation's demand for the equipment it needs to fulfill its industrial and fuel-power program and provide construction equipment for the building of the Baykal-Amur railway and gas pumping equipment and machinery for natural gas pipelines. In recent years, there have been created systems and complexes of machines and technical equipment, industrial robots and flexible production systems and modules that can provide continuous mechanized and automated production processes.

Highly efficient technology for nuclear power plants, the mining and petroleum industries, ferrous and nonferrous metallurgy, transportation and other industries have been developed and introduced on a large scale.

In the plan for 1985, the first year of the 12th five-year period, tasks have been established in all areas of scientific and technical progress. These tasks have been oriented at creating new types of machinery and equipment and seeing them put to use in industry, increasing the introduction of advanced technologies and renewing the production both of new and of reconstructed or modernized plants. The plan calls for industry to adopt more than 2900 standard sizes of new types of equipment that meet the requirements that international scientific and technical progress has set for output, precision, reliability, economy and less consumption of materials. The specific weight taken by products of the above quality category in the overall volume of production has been raised to 42 percent. About 1400 obsolete machines and items of equipment will be removed from industry and the manufacture of products made for another three years will amount to 30-40 percent of the output of most of the machine tool ministries.

A switch has been planned from creating individual machines to building automated systems that can perform entire technological processes. For the agricultural machinery industries, road construction, mining, chemistry, lumber handling and other such industries in particular, these will be built on the basis of the aggregate-module principle. The switch to such machine systems should make possible large-scale mechanization and automation of all stages of production and to coordinate the basic parameters of individual machines that form a link in the production process and on that basis hasten the technical re-equipment of different industries.

There will still be other changes made in the machine tool industry itself. For 1985 and later years, a high priority will be given the development of computer technology, machine building, electronics, tool building and the agricultural machine industry. Thus, in the tool building industry, the output of high-speed forges and presses will increase by almost 13 percent while the output of NC machines and roboticized press complexes will increase 130-150 percent.

The machine industry's ministries have oriented themselves toward large-scale replacement and active renewal of the equipment used in basic production. They plan to introduce within one year about 4000 NC machines and press forges including about 400 machine centers. The yearly plan calls for the manufacture of more than 2000 flexible production modules and systems. There will be installed about 5000 industrial robots and more than 1000 new continuous-mechanized, conveyor, automated and semiautomated lines. More types of equipment are being supplied with microprocessor technology. This is only the beginning of a large-scale and very long-term project. According to the plan, the level of mechanization and automation of labor will increase as much as 65 percent in the machine building industry (the very largest group of industrial workers) and more than 56 percent for loading and unloading, transport and storage work.

It is now necessary to take all possible measures to put equipment to the best use. At the present time, many factories use their high-output NC machines for less than 1.5 shifts. By the end of the year, it will be necessary to increase the shift coefficient of NC machines to 1.65 and of high-output unique technological equipment to 2.5.

Special attention has been given to increasing the labor productivity of designers, builders and technologists. They will receive more than 300 computer-aided design systems and automated job slots.

In 1985, the use of advanced and material-saving technologies will be increased. These technologies include economic ways of cutting and stamping blanks from sheet steel, the production of items from powdered metal and items with wear-resistant coatings and methods of hot plastic deformation. Thus, the AvtoZIL production Association has introduced a complex of low-waste technologies for manufacturing shafts, axles and gears. This technology can reduce the metal use coefficient to 0.72 and lower by 30 percent the amount of rolled metal used to make these parts.

A considerable growth in metal savings can be provided by technological processes of plastic molding of parts that are under superplastic conditions. For example, the Progress stand manufactured by the Savelovo Production Association for reeling out under superplastic conditions parts of up to 1 m in diameter from alloys that are hard to deform has increased the metal use coefficient by 5-6 times. This stand is equipped with an NC programming device and it unwinds parts automatically. The stand can be quickly adjusted from one part to another. These stands can be used to create automated lines and flexible production systems.

At the present time, the development and introduction of advanced technological processes that use new forms of energy, lasers and less power-intensive, waste-free and low-waste technologies are becoming increasingly important.

Laser technology can give more than a double gain in the basic indicators of known technological processes make it possible to carry out completely new operations.

Lasers are able to cut refractory metals, ceramics, tissues, plastics, wood and composite materials. The process is so quick that the surface does not have time to heat up substantially. The material properties in the cutting zone remain practically unchanged and parts do not become deformed due to any extreme stresses. Expensive cutting instruments made of super-hard materials that are quickly worn out are no longer necessary. The high quality of technological operations makes it possible to avoid subsequent working of the parts. Laser cutting is therefore very effective in ship building, aviaional construction, electronics and other branches of the machine building industry for cutting materials, punching holes, cutting out depressions and marking parts. Up to 70 percent of cutting costs can be saved by using lasers.

The Ministry of Automotive Industry and the Ministry of Agricultural machinery have substantially broadened the scale of their use of parts and items with high-strength coatings as well as their regeneration by plasma-gas spraying which reduces the demand for spare parts for automobiles, tractors and agricultural machinery by increasing their service lives.

The replacement of uneconomic types of steel castings by welded structures that can save as much as 25 percent on metal content has been considered. In the general structure of blank production, the portion of welded structures is already more than half and during the 12th five-year period, this tendency will continue. Progressive forms of welding are very promising. These include electron-beam, plasma, laser, explosion welding, friction welding, radio- and high-frequency welding and contact welding in a medium of protective gases. As a rule, they will be used on flexible automated lines and robotic complexes and increase the metal use coefficient by 5 percent.

Thanks to the introduction of new technological processes, the coefficient of metal use will reach 0.8 in 1985.

Plants that have been actively working to reconstruct and re-equip their production have had very good results in improving the quality of their

products and output. Thus, the technological solutions used to reconstruct and re-equip the Moscow Electromechanical Factory imeni Vladimir Ilich satisfy prospective directions for the development and the introduction of new equipment and technology, providing a high degree of production mobility through the creation of flexible automated lines, sections and complexes on the basis of the most advanced equipment.

The mechanization and automation of production processes, creation of roboticized complexes, lines, sections, automation of storage and transport systems as well as the large-scale resolution of the problems of organization and control of the production process by using automated production control systems, automated technological process control systems and computer-aided design allows a plant once it completes its reconstruction to substantially increase the quality of its products, lower labor-intensiveness by 3-4 times, increase by more than three times its output with a lower number of workers and to considerably increase the shift factor of equipment operation by operating it over three shifts with a minimal number of personnel.

The creation of such processes will allow our industry to gain the experience it needs and therefore copy them in many other branches of industry.

Greater development of the national economy in 1986-1990 will to a large extent depend on the pace of growth and the potential of our machine tool industry and increased cooperation with other socialist countries in the creation and production of the most advanced machinery, equipment and instruments.

The main goal is to raise machine building to a new and higher technical level and improve the quality and reliability of products during the 12th five-year period. We must also mass produce new types of high-output and competitive equipment that meets the standards of international scientific and technological progress, stop production of obsolete equipment and on this basis resolve the problem of amply satisfying the nation's need for machines, instruments and equipment.

The primary tasks facing the machine tool industries are:

- expanded fundamental research and development providing a scientific surplus for the 12th five-year period and more long-term perspectives;

- development and creation of new scientific, technical and experimental potential, increasing the technical sophistication of plants and associations, perfection of specialization and cooperation, extensive re-equipment of the entire scientific and industrial apparatus and substantial improvement of the quality of products, increased development, quicker transition to production of the new generation of competitive machinery, equipment and instruments on the basis of modern technological and organizational solutions;

- planned and more efficient use of scientific, technical and industrial potential in the interests of hastening the intensification of the entire national economy, fulfillment of the USSR Industrial and Power Program, the Comprehensive Program for Growth in the Production of Consumer Goods and



Services for the Period Up to 2000, re-equipment and renewal of the industrial apparatus in ferrous metallurgy, the chemical industry, transportation and further industrialization of capital construction;

-- rational and more economical use of all types of resources and especially metal and secondary resources;

-- advanced planning of indicators of scientific and technical progress, greater scale of the introduction of economic experiment with the help of systems of planned indicators and norms;

-- closer cooperation between the machine building ministries and plants in CEMA member nations to create and manufacture advanced machinery, equipment and instruments by expanding and intensifying specialization and cooperation and by increasing the trade in machine tools;

-- development and introduction to industry of advanced technological processes using new forms of energy, lasers, less power-consuming waste-free or low-waste technologies that can save substantial amounts of metal and sharply reduce metal waste, creation and introduction of entirely new forms of power installations, technological complexes, transport devices and other types of equipment that can substantially reduce the consumption of fuel and energy and also increase labor productivity.

In order to increase the technical level of the machine tool industry during the 12th five-year period, the pace for introduction of flexible production systems will be increased 1.8 times while industrial robots are to be brought into industry twice as fast. In the production of a small list of parts, flexible production systems make it possible within a short period of time to switch to the manufacture of a related product. The cost of this switch comes close to that achieved under conditions of continuous mass production. Measures are being taken to increase the introduction of automated and semiautomated NC equipment with the use of built-in microprocessors, rotary and rotary-conveyor lines and computer-aided design and control systems. In this way, the machine tool industry can in 1986-1990 replace more than 300,000 employees. It has been planned to remove from different branches of the machine tool industry its worn-out and obsolete equipment by 1990.

The re-equipment of industry especially based on the introduction of flexible production modules and systems, NC equipment, "machining aggregate" lathes with the use of microprocessor technology and minicomputers will make it possible to fundamentally improve production conditions and output. With the introduction of automated technology based on electronics, the nature of the work of machine operators and tool setters is changed. It becomes more creative and skilled and this contributes to increased labor productivity and solves many social problems.

It is extremely important to broaden and intensify specialization and cooperation between branches of the machine tool industry. Broad specialization of production, as compared to unification and use of modular principles of design of new machine systems, makes it possible to most efficiently use machining aggregates, robotic complexes and flexible

production systems, to hasten the renewal of finished production and raise its quality.

It is necessary to strengthen contacts with related industries by establishing direct links and setting up extensive agreements. It is very important to more extensively exchange progressive experiences in the area of technology and the organization of production and labor.

The realization of control assignments worked out at this time by the machine tool ministries for 1986 and the 12th five-year plan to increase the technical level of industry and improve product quality, the introduction of advanced technological processes will in 1990 increase the reliability and service lives of the most important products, their fuel and power economy and lower the specific metal content of machines and equipment.

The amount of new machine tool production within the next three years will grow by 200-300 percent while extensive modification and replacement with new highly-efficient equipment will considerably reduce the manufacture of production older than 10 years. With regard to buyer demands, the organization of new production has been planned for new generations of systems, automated lines, sets of press forges and agricultural machinery and tractors that will be 1.5-2 times more productive than our present equipment as well as entirely new types of equipment and technology that can increase labor productivity by no less than 300-500 percent.

In solving the task of improving the machine tool industry and satisfying the national economy's demand for high-quality machinery, the most important factor is the further development of cooperation with other countries of the socialist community.

At the present time, the CEMA member nations have developed a strong industrial potential. They produce 25 percent of the world's machinery and equipment.

Continuous perfection of the types and forms of cooperation in the machine tool industry and its purposeful orientation toward intensification of consumer production will be accompanied by efficient development of the national economy of each country and broadening of their participation in the international socialist division of labor.

In a statement on the basic directions for further growth and intensification of economic, scientific and technical cooperation of the CEMA member nations adopted at the High-Level Economic Conference of June 1984, it was said that in the machine tool industry growth will be of a comprehensive character and aimed mainly at providing key industries with machinery and equipment of a world standard of high quality. The production of both finished products, parts and components and general-purpose machine parts is called for along with the production of spare parts for mutually-produced equipment. Special attention here will be given to the development of electronics, the production of microprocessors, robotics and flexible production systems.

A characteristics of the present stage of CEMA machine tool cooperation is that it covers all stages of the creation and production of new technology and a switch to the development of machine and equipment systems based on standardized aggregates, components and parts that can solve on a large scale the problems of branch and inter-branch production.

In coordinating economic plans, work is also being done to improve the technical level and quality of products. This is an important instrument in strengthening and encouraging cooperation between our nations and in establishing and intensifying specialization and cooperation of economic complexes in order to solve the tasks facing our countries, especially those involving the improvement of the quality of cooperative machine tool production.

In order to realize tasks for accelerating scientific and technical progress and raise the technical and economic level of the machine tool industry, the 34th Meeting of the CEMA Session decided to form the CEMA Committee on Machine Tool Cooperation. In April 1985, the latest conference of this committee was held in Moscow and it considered a series of prospective and current problems in the work of the committee and its working organs. A position on the committee was drafted and a list of its permanent working organs was approved.

The conference approved proposals for a list of high-priority problems in cooperation set the deadlines for the working out of concrete agreements including ones involving the creation and organization of specialized production of unique heavy-duty machines, road-working machinery, self-propelled mining equipment for underground work, future airplanes and helicopters for civil aviation, modern medical equipment using microelectronics, etc.

The conference also prepared and adopted a plan for the committee's work for 1985-86. This plan called for the development of basic directions for economic, scientific and technical cooperation in the machine tool industry for 1986-1990, prospective programs for development of multilateral specialization and cooperation in the production of specific items until 2000 and may other projects. A draft of a general agreement on cooperation to produce flexible production systems and introduce on large scale to the national economy was prepared and recommended for signing by the CEMA Session.

The decisions of the committee are aimed at providing key industries with machinery and equipment of high quality, development and intensification of specialized and cooperative production of both finished products as well as parts, components, aggregates, completed structures and the technical re-equipment of the machine tool industries of the socialist countries.

The token of success in greatly hastening scientific and technical progress is exemplary organization of work in all segments of the process of scientific and technical creativity, from the birth of an idea to the mass production of a new product, and the responsibility of the workers of the machine tool industry to do everything possible to quickly lead industry along the way to



intensive growth and greater efficiency in public production and to meet the 27th Congress of the Communist Party of the Soviet Union with concrete deeds and new achievements.

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## INDUSTRY PLANNING AND ECONOMICS

### INTENSIVE DEVELOPMENT OF MACHINEBUILDING INDUSTRY TO 1990

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 6, Jun 85 pp 3-13

[Article by Professor G. Stroganov, doctor of technical sciences; deputy chairman, USSR Gosplan: "Basic Trends in the Development of the Machine-Building Industry"]

[Excerpts] The April (1985) CPSU Central Committee plenum heard it emphasized that "as the critical lever with which to effect a strategic intensification of national economic development and as the best means of exploiting accumulated potential, the party is focusing upon efforts to achieve a radical acceleration of our advancement in science and technology.... We need to bring about truly revolutionary advances such, for example, as introducing fundamentally new production and engineering technologies, to technologies of the latest generation which offer the highest levels of efficiency. What we are really talking about here is reequipping, retooling all branches of our national economy on the basis of the latest advances in science and technology."

Playing a leading role in efforts to achieve these objectives is the machine-building industry—priority given to the development and overall modernization of this industry will make it possible to introduce the latest advances in science and technology in our industrial production operations on a broad scale. Contributing to this end as well should be our aggressive structural policy in the area of the development and modernization of fixed productive assets, the objective of which is to achieve economies in the use of manpower, investment and material resources. The biggest share of our capital investment should be going not to expand the production apparatus, but rather to replace losses in productive assets due to wear and tear and the obsolescence of the means of labor, particularly of the active component—machines and equipment in basic production along with production technologies.

Effective modernization of fixed productive assets requires the use in our production operations of new, high-efficiency machines, equipment and tools and the latest in technologies. Most effective in this respect is the reequipment and modernization of production facilities, to which we should earmark over half of total capital investment.

Each new year sees increases in the production of sophisticated new tools and equipment and growth in the manufacture of multipurpose machines and facilities and automated, numerically controlled machine tools and machining centers, some of which are fabricated on an international cooperative basis. We have improved the product mix of our machine-building industry and introduced qualitative modifications in a great many of the industry's products. Unit capacity, productivity and reliability are up, while the specific material and energy consumption of machine and equipment are down.

The machine-building industry is also solving the major problems involved in meeting the country's need for machines and equipment essential to successful implementation of the food and fuel and energy programs, machines and construction equipment for construction of the Baykal-Amur Main Line and gas pumping systems and machines for our gas pipelines. Recent years have seen the development as well of machine and equipment systems and complexes, industrial robots and flexible production modules and systems for continuous, mechanized and automated production processes.

The machine-building ministries are focusing on the objective of completely replacing and modernizing the machine and equipment inventories in basic production facilities. Plans for the year call for the introduction of some 4000 numerically controlled machine tools and forging-and-pressing units, to include somewhere in the neighborhood of 400 "machining centers." The annual plan calls for the production of over 2000 flexible production modules and systems. The industry will also be delivering more than 5000 industrial robots and over a thousand new continuous, conveyor, automatic and semiautomatic production lines. Many types of equipment are being provided with microprocessor systems. And this is only the beginning of a major and highly promising effort. Plans call for the level of the mechanization and automation of labor in the machine-building industry, the largest workforce in our industry, to rise to 65 per cent and to top 56 per cent in freight handling, transport and warehousing operations.

It is now essential that we begin to do everything we can to insure that we put our machines and equipment to the best possible use. The high-productivity NC machines in many plants are still being used for less than 1.5 shifts. Plans call for the shift-use factor for NC machines to rise to 1.65 by the end of the year, that for our high-capacity special-purpose machinery to come up to 2.5.

We are giving particular attention to efforts of the productivity of the labor of our planners, designers and production engineers. For them we will be developing and introducing more than 300 automated design systems and automated work stations.

Now assuming major importance is the development and introduction of the latest in production processes based on the use of new types of energy and laser systems, processes which consume less energy and which generate no waste, or at least less waste.

Laser technology is yielding more than double the gain in the basic indicator categories for the conventional production processes and making it possible to develop entirely new operations.

Lasers can be used to cut refractory metals, ceramics, fabrics, plastic, wood and composite materials. The process occurs so rapidly that a surface is never heated to any great degree, the properties of the material in the vicinity of the cut remain virtually unaltered and the object is not deformed by residual stresses. Laser technology eliminates the need for costly, rapidly wearing tools made from superhard materials. The high quality of the laser-based process also makes it possible to dispense with any further product finishing operations. Laser cutting is therefore employed with great effect in the ship-building, aviation, electrical equipment and other branches of the machine-building industry to cut materials, open up holes, hollow out depressions and to mark objects. Savings on cutting operations are running as high as 70 per cent.

We are seeing substantial improvement in product quality and increases in production volume by enterprises which have taken vigorous steps to modernize and reequip production facilities. The engineering solutions adopted for the modernization program for Moscow's Vladimir Ilich Electrical Equipment Works, for example, are in line with long-term plans for the development and introduction of new equipment and technology targeted on the objective of high production mobility to be achieved with the use of flexible automated production lines, sections and systems incorporating the most up-to-date equipment.

The mechanization and automation of production processes, the development of robotized systems, lines and facilities, the automation of warehousing and transport systems and integrated solution of problems involved in the organization and control of production operations based on the use of automated production control systems (ASUP), automated process control systems (ASUTP) and automated design systems (SAPR) will permit a plant which carries through with its modernization program to achieve substantial improvements in product quality, reduce the manpower input 3-4-fold, increase output more than 3-fold in the same production facility using fewer workers and substantially increase the shift-use factor for production equipment with the introduction of a 3-shift operating schedule employing a minimum number of operating personnel.

The development of this type of production operation is going to enable the domestic industry to accumulate an essential fund of experience and then to introduce them in many enterprises in different industries.

We are now engaged in an effort to improve the operation of the economic mechanism overall. The machine-building industries are playing an active role in a large-scale economic experiment. Enterprises participating in this experiment are operating more efficiently and responsibly, making greater use of the intensive factors of economic development and increasing production volume essentially without increasing the number of personnel involved. Quality indicators are playing an increasingly important role in the planning and evaluation of the operation of the machine-building enterprise, and we are developing a system of control targets in the area of scientific and technological development and programs to insure that efforts to meet these targets will be supported by all necessary resources. We are seeing in this connection a greater emphasis on responsibility and discipline and on the operation of economic controls and incentives in accelerating the development, assimilation and introduction of new equipment and technologies in production operations, in tightening contract

discipline and in increasing the share in deliveries of machine and equipment systems and facilities, to include those of modular design.

In the meantime, however, our planning system and the existing economic mechanism are still not doing enough to insure the fullest possible exploitation of the latest advances in science and technology and the most recent domestic and foreign experience. Even in industries which are now operating under the conditions of the economic experiment, we still see the parallel functioning of two systems of planning and incentives: the objective of one is to increase production volume and reduce overall expenditures, that of the other to advance the pace of progress in science and technology as the most effective way to increase production volume and achieve economies in the consumption of resources. Under these conditions, the enterprise is offered better incentives and bears greater responsibility for fulfilling its plan with respect to production volume and product deliveries within the terms of a contract than for the production and introduction of new equipment and technologies.

If we are going to accelerate the pace of our advance in science and technology we are going to have to create conditions under which plan fulfillment and economic progress become impossible without the development, assimilation and introduction of new equipment and technologies. So in the next phase of our economic experiment the participants are going to have to be armed with more precisely defined norms and directed to focus on the top-priority objective, that is, to work toward an overall acceleration of the pace of research and development work, the introduction and assimilation of the latest advances in science and technology and the dissemination and borrowing of the latest available experience here at home. In this connection we must also begin working on the development of an integrated management and control system.

Any intensification of the pace of our national economic development over the period between 1986 and 1990 is going to depend to a substantial degree on the rate of growth and the potential capacity of our domestic machine-building industry and the expansion of cooperation with countries of the socialist community in the development and production of the latest in machines, equipment and instruments.

The ultimate objective is to raise the machine-building industry to new heights of technical performance over the course of the Twelfth Five-Year-Plan period and to begin turning out products of better quality and higher reliability. To begin mass-producing new types of competitive, high-capacity machines and equipment which will measure up to the requirements of world progress in science and technology, to end the production of obsolete, general-purpose equipment and on this basis to solve the problem of meeting the quantitative demand of our national economy for machines, instruments and equipment.

The top-priority tasks now before the machine-building industry are the following:

to broaden programs of basic research and development with a view toward laying a solid scientific foundation for the Twelfth Five-Year-Plan period and beyond;

to develop and build new scientific, technical and experimental capacities; raise the technical level of enterprise and association operations; improve the pattern of specialization and cooperation; completely retool our scientific research and

production facilities with the objective of realizing substantial improvements in the quality of our finished production, stepping up the pace of the research and development effort and rapidly making a new generation of competitive machines, tools and equipment available to industry through implementation of the latest in organizational and technological solutions;

to insure more effective, systematic utilization of scientific, technical and productive capacities in the interest of accelerating the intensification of the country's economy as a whole, implementation of the USSR's food and energy programs and its integrated program for expanding the production of consumer goods and services over the period extending to the year 2000, retooling and modernizing production facilities in the ferrous metallurgy, chemical and transportation industries and continuing efforts in the direction of the industrialization of capital construction operations;

to insure more efficient, more economical use of all types of resources, particularly of metal and the secondary resources;

to begin advance planning of indicators designed to gauge progress in science and technology and enlarge the scale of the economic experiment with the use of a system of planning indicators and norms;

to work for closer cooperation between our machine-building ministries with enterprises in the Comecon member countries in the joint development and production of advanced new types of machines, equipment and instruments on the basis of more extensive and intensive specialization and cooperation and increased turnover of the machine-building industry product and

to develop and introduce into production operations advanced new production processes employing new types of energy, laser technology and less energy-intensive, waste-free or low-waste technologies making possible substantial economies in the consumption of metal by cutting metal wastage and developing and introducing fundamentally new types of power plants, production facilities, transport systems and other new equipment which will make it possible to achieve sharp reductions in fuel and energy consumption and increases in production manpower productivity.

We will also see further advances in the development of advanced new types of plastic blank deformation—extrusion, radial forging, rolling, hot knurling, reduction, superplastic shaping, hot plastic metal deformation, economical methods of cutting and stamping blanks from sheet steel, the production of articles with protective and wear-resistant coatings and from metal powders—these would by no means exhaust the list of new technologies which are going to be extensively employed in the machine-building industry.

The development of equipment and facilities of a new generation requires the extensive use of automated design systems, vigorous steps to develop and build well-equipped new experimental facilities for testing and applying new engineering solutions to be incorporated in the design of new machines and equipment and resolving problems associated with the implementation of these solutions, definition of the initial engineering-economic characteristics of the machines and systems to be developed and the conducting of a substantial proportion of the tests

and experiments involved on extensively computerized test stands. Experience has demonstrated that problems involved in efforts to improve the quality, raise the technical level and enhance producibility will be solved more successfully when new equipment is developed on an integrated basis with the participation of specialists from production facilities engaged in series production and scientific research and engineering institutes.

Design organizations should move more rapidly to adopt standardized component systems for use in a variety of designs and standardized products used in more than one industry incorporating a wide range of standardized components.

Technical standards charts should play a major role in efforts to improve the quality of our machine-building industry product. These charts will make it possible to focus the attention of individual members of the workforce on the need to work for high quality and technical standards of the machines, equipment and instruments in production at all stages of the production process.

The system of coordinating deliveries of new machines for series production operations also needs to be greatly simplified.

With the objective of raising the technical level of machine-building production operations, the Twelfth Five-Year Plan calls for a 1.8-fold increase in the pace of introduction of flexible production systems and a twofold increase in the rate of introduction of industrial robots. Flexible, multipurpose production systems used in multinomenclature production operations offer the possibility of changing over in only a short period of time to the production of similar or related items, the cost of which production is in the neighborhood of the cost of continuous mass production. Steps are being taken in the direction of extensive introduction of automatic and semiautomatic NC equipment incorporating built-in microprocessor systems, rotary and rotary-conveyor lines and automated design and control systems. With the introduction of these measures, the period 1986-1990 should see the machine-building industry move into a position to free up over 300,000 workers. Plans also call for the various branches of the machine-building industry to be increasing the proportion of obsolete and worn-out equipment removed from the inventory by 1990.

The retooling of production operations, particularly on the basis of integrated solutions involving the introduction of multipurpose NC modules, systems and machines and microprocessor- and minicomputer-controlled machining centers, will make possible a substantial improvement in working conditions and increase labor productivity. The introduction of automated electronic systems will also alter the nature of the work performed by machine repairmen and operators. The work these members of our workforce do will become more creative and require more skills and qualifications, which in turn will help increase labor productivity and solve a number of social problems.

Plans also call for greater intensification of manufacturing operations through more extensive reproduction of models of promising new machines and technical, engineering and organization solutions, retooling and modernizing enterprises which have fallen off the pace in these efforts, insuring the establishment of effective links between basic and secondary, supporting production operations and increasing the efficiency of the services performing these preliminary operations in support of basic manufacturing.



Other plans call for accelerated development on the basis of a number of ministry associations and enterprises of new capacities for the fabrication of new special-purpose production facilities, equipment and instruments for our own use. The ministries of the automobile industry, tractor and agricultural machine building and instrument making, automation equipment and control systems have already accumulated a fund of positive experience in this important effort. The ministry of the automobile industry, for example, has fulfilled its plan for metal-working machine production for its own purposes to the extent of 132 per cent.

Fulfillment of control targets for raising the technical level of production, improving product quality and introducing advanced new production processes now being established for the machine-building ministries for 1986 and the Twelfth Five-Year-Plan period will make it possible by 1990 to improve the reliability and operating life of the most critical types of machine-building industry products, increase fuel and energy economies and cut specific metal consumption of machines and equipment.

The share of new machine-building industry products in production up to three years will grow 2-3-fold, while that of products in production over 10 years should decrease sharply with thoroughgoing modification and replacement by new high-efficiency equipment. With the requirements of the customer in mind, plans also call for the production of new generations of production systems, automatic machine lines, forging and pressing systems and tractors and other agricultural machinery, which will be 1.5-2 times more productive and efficient than those presently in production, and fundamentally new types of machines and equipment and new technologies which will increase labor productivity at least 3-5 times.

A most critical factor in solving the problems involved in modernizing the machine-building industry and in meeting the national economy's demand for high-quality industry products is the development of closer cooperation between the countries of the socialist commonwealth.

The Comecon member countries have now developed a machine-building industry of enormous potential. They presently account for 25 per cent of total world production of machines and equipment.

Continuous improvement of the various types and forms of cooperation in the machine-building field and the effective orientation of the industry toward more intensive social production will contribute to the effective development of the national economy of each one of the collaborating countries and expand their participation in the international socialist division of labor.

The declaration outlining basic directions for the development and intensification of economic, scientific and technical cooperation among Comecon member countries adopted by the high-level economic conference in June 1984 points out in the area of machine building it will be a fully integrated collaboration focusing first and foremost on providing the critical branches of the industry with high-quality, world-class machines and equipment. Plans call for the production of finished products, individual parts and components and products used throughout the machine-building industry and complete supplies of spare parts for all equipment delivered by all parties. Particular attention will be given



to the development of electronics and the production of microprocessors, robot systems and the flexible, multipurpose production systems.

Characteristic of the present stage of cooperation among the Comecon member countries in the area of machine building is that it encompasses all phases of the development and production of new machines and that it is moving in the direction of the development of new machines and equipment incorporating standardized units, assemblies and components for integrated solution of major industry and interindustry problems.

We are also raising the technical level and improving the quality of industry products through the coordination of national economic plans, which is an important instrument by means of which to strengthen and develop cooperation between our countries and through the encouragement of specialization and cooperation of national economic complexes with the objective of solving the social and economic problems facing our countries, particularly when it comes to the matter of improving the quality of the machine-building industry products we supply one another.

With the objective of coordinating an approach to the problem of accelerating our progress in science and technology and raising the technical-economic level of the machine-building industry, the 39th meeting of the Comecon session decided to form the Comecon Committee on Cooperation in Machine Building. The committee recently, in April 1985, held one of its regular meetings in Moscow. Participants discussed a number of the long-term and short-term questions concerning the work of the committee and its standing bodies. They agreed upon a draft committee statute and approved a list of standing committee bodies.

The committee also approved a document outlining the priority problems involved in this cooperative effort and established a schedule in accordance with which concrete agreements will be reached concerning solutions to these problems, which include the task of developing and organizing the specialized production of specially designed heavy machines, road machinery, self-propelled mining machinery for underground operations, advanced new fixed- and rotary-wing aircraft for civil aviation, microelectronic medical equipment etc.

The committee drew up and approved a committee action plan for 1985-1986 which calls for the preparation of a document establishing guidelines for the development of economic, scientific and technical cooperation in the area of machine building for the period 1986-1990, long-term programs for the development of multilateral specialization and cooperation in the production of selected items of equipment over the period extending to the year 2000 and a number of other programs. The committee also approved and recommended for Comecon session signature a draft general agreement on multilateral cooperation in the development and organization of specialized and cooperative production of flexible, multipurpose production systems and measures to be taken to insure the extensive introduction of these systems throughout the national economy.

The decisions of this committee have been made with the objective of providing the key sectors of production with high-quality machines and equipment, developing and intensifying specialization and cooperation in the manufacture of both finished products and individual components, assemblies and units and, finally,

of retooling and improving the structure of the machine-building industries of the countries of the socialist community.

Effective, exemplary operational organization at all stages of the scientific-technical development process, from the birth of the idea to series production of a new product, is a guarantee of success in the effort to stimulate a rapid acceleration in the pace of our scientific and technological advance; and it is the job of the workers in the machine-building industry to do everything they can to switch the industry onto the intensive development track as quickly as possible, improve the efficiency of social production and salute the 27th Congress of the Communist Party of the Soviet Union with concrete deeds and new achievements.

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## INDUSTRY PLANNING AND ECONOMICS

### TECHNOLOGICAL, ORGANIZATIONAL ROADBLOCKS TO FMS DEBATED

Minsk NARODNOYE KHOZYAYSTVO BELORUSSII in Russian No 9, Sep 84 pp 9-14

[Discussion between Dmitri Dmitrievich Gorlanov, plant director at the Granat Scientific Production Association, Anatoly Ivanovich Myasnikov, division director at the Granat Scientific Production Association, Vladimir Yevgenievich Sobolev, director of the new technology Planning Division of the Belorussian Gosplan, Gennady Ivanovich Khutsky, dean of the Robotics Faculty of the Belorussian Polytechnical Institute and Viktor Ivanovich Goryushkin, chairman of the Machine-Building Technology Faculty at the Vitebsk Technological Institute, moderated by NARODNOYE KHOZYAYSTVO BELORUSSII correspondent V. Ponomarev: "Flexible Production Systems: What Will It Cost Us to Build FMS?"]

[Text] It was like a fairy tale...Everything was being done by itself. Mechanical hands pulled a blank from out of somewhere and set it into a mini-automobile. This found its way faultlessly through the complicated shop labyrinth and took the blank to the necessary machine. At the very same second, that machine finishes machining a part as the new blank is quickly loaded into it. And the blank proceeds from machine to machine, presenting one side to a mill and then the other to a drill until it emerges as a gleaming finished part with polished surfaces.

This was not science-fiction but a training film showing how a flexible automated production system works at one of our plants. The notions of work that we usually associate with man and the hands of a worker have lost almost all sense here because everything takes place in this shop does so without any people and not even light is needed. So what? Surely we have all seen how automated machines can bake bread or very nicely package candy. Is this not the same thing?

There is a substantial difference. First of all, a modern machine, and this film was about the production of machine tools, is not candy. Second, traditional automated machinery is set once and for all for the production of even the simplest item. The production of new items, which usually

occurs every few years, requires the installation of new machinery. This is not limited to the replacement of just one machine either. The entire plant organism must be readjusted. In automated flexible production, the same machines can make different parts in any order (or to be more exact, in the required order) without being reset. Consequently, they can be put together to form different types of machines to turn out diverse items such as automobiles, watches, cameras, etc.

And finally, the main point: the film showed a production prototype where man's participation is reduced to its minimum minimum not only in production but also in design work. In essence, man's only remaining task is to formulate specifications for the new production and assign technical principles and he does that only where subjective factors such as taste and fashion are a part of the production of shoes or furniture. In the production of complicated technical items which are not a matter of consumer taste but engineering feasibility, a computer does much better.

What is there left for man to do? Man is not to be the servant of machines and mechanisms but their commander. According to some prognoses, by the end of our century, only two to three percent of the workers presently employed in machine building industries will remain there. This means that there will be opened up uncounted possibilities to discover new qualities in science, art and other forms of creativity.

We will not, however, just look at the distant future. At the present time, we still think of industry as machines and the workers bent over them. The scenes from this film, shown not to dilettantes at all but to scientists, engineers and factory directors, may have aroused surprise or even ironic laughter among other viewers but those that saw it did not come to dream or be surprised but to do something concrete and to hasten the introduction of flexible automated production to our industry.

To discuss the problems of this process, we have invited to our "round table" some participants to the conference.

The participants to this conversation were: Dmitri Dmitrievich Gorlanov, plant director at the Granat Scientific Production Association, Anatoly Ivanovich Myasnikov, division director at the Granat Scientific Production Association, Vladimir Yevgenievich Sobolev, director of the new technology Planning Division of the Belorussian Gosplan, Gennady Ivanovich Khutsky, dean of the Robotics Faculty of the Belorussian Polytechnical Institute and Viktor Ivanovich Goryushkin, chairman of the Machine-Building Technology

Faculty at the Vitebsk Technological Institute and  
correspondent for NARODNOYE KHOZYAYSTVO BELORUSSII.

[Moderator] I would like some impressions of the conference. Above all, did it justify the hopes of specials directly involved with the problems of automated production, specialists such as, for example technologists?

[V. Goryushkin] Every technical idea goes through four stages of development. In the beginning, it is generally rejected and suspected. Then people begin to see it as the panacea to all problems and this is followed by a period of general enthusiasm and hullabaloo. Finally, it becomes intelligently used and is then displaced by the birth of a new idea.

The term "flexible automated production" was recently coined. Just a couple of years ago at similar conferences we heard mainly two questions: what and why? In other words, even among the specialists there were many who doubted the new idea and others who completely opposed it. Now, we have, in my opinion, successfully passed through the first two stages and are approaching the third. Therefore, at the conference, we heard for the most part just one question about this new idea: how? In what order and by what means are we to create FMS? How are we to improve its reliability and economy? Many reports described how the first FMS systems were created and are being operated. That is delightful.

However, as said at the closing session, almost none of the participants made any attempt to "jump" ahead several steps. In other words, we are preceding as if we are afraid to step on our own shadows. We need to look further, see our perspectives and take really serious measures.

[A. Myasnikov] I think that there are still too few specialist asking why we must have FMS. Here is a very simple example. The traditional industrial hierarchy that we have had for years has consisted of crews, foremen, section managers and shop managers. We try to fit a completely new industry mechanism such as FMS into the old organizational forms and we forget that neither the foreman nor the master machinist are needed any longer.

There is the concept of standards of operability. If a shop employs, say, 800 workers, this is a category I shop and you, as its director, make a good salary. Let us suppose that you have introduced flexible production and reduced the number of workers by 200. You have therefore reduced your shop to the third category and automatically deprived yourself of a large part of your earnings. Would such a prospect be much of an incentive?

[Moderator] Such a great undertaking cannot depend on the whim of the shop director or even the chief engineer. This is an objective process and must be determined by economic considerations.

[A. Myasnikov] The idea of FMS can, of course, be foisted "from up top" in the instructed order but, as experience with FMS has shown us, success can only be counted on when every one involved in the project, from the tool-setters to the minister, not only realizes it but is also directly interested

in its successful realization. It is not only the persons against FMS that must be excluded but also those indifferent to it.

[Moderator] In the last few years, we have already met many of those here today at various establishments involved in the problems of robotics. This was not a regional conference but an All-Union seminar. Factory engineers predominated at regional conferences while at the latter, it was the scientists and theoreticians. The organizers of these different conferences have been scientific and technical societies, regional party committees and republic ministries...On the one hand, it is a pleasing fact, that no one is indifferent, as you say, and that the problems of robotization are at the focus of everyone's attention. However, on the other hand, all of this work seems to be somewhat chaotic. As we know, what is important in technology is not only the magnitude of the force but also the point of application and the direction...Otherwise, nothing will come of it.

[V. Sobolev] Look at the list of institutions that have taken part in our conference: Gosplan and BRS [not further identified] of the Scientific and Technical Society, TsNIITU [not further identified] and the Belorussian Academy of Sciences and production and scientific production associations...This again demonstrates that everyone is together and working in the same direction.

About 250 participants were invited to the conference but nearly 500 came. The conference hall even turned out to be too small. In a word, the interest in flexible production systems has exceeded all expectations. Furthermore, this interest is not idle curiosity but is earnest and concrete. People came to Minsk for experience and advice. It turned out that the majority of specialists involved with FMS are trying to find their way. We already have a good number of FMS designs but they tend to overlap one another. Experience in the use of robotics has shown that if we cannot standardize this technology in its first stages, the differences will continue to grow. That is why a series of measures has been taken recently to accelerate the use flexible adjustable complexes in the machine tool industry. The chief ministries and organizations to be involved in the creation of different types of equipment and the development of standards and cadre training have been named.

In Belorussia in particular, 6 model flexible automated production sections are going to be built during the 12th five-year period for instructional uses. In December of last year, the Republican Interinstitutional Council of Large-Scale Industrial Automation was formed. The Council named the Granat Science and Production Association as its working organ.

Why did they choose this particular association? For several years, it has already been involved in the robotization of industry and has actually become the leading institution in Soviet robotics. It has much experience not only in the creation of new designs for robots and manipulators but also in work that is directly connected with the introduction and use of robots and manipulators to industry. It has carried out preliminary investigation of the production, activation and organization of cooperative production of the necessary equipment, service and technical consultation.

The chief task of the council is the coordination of all work on flexible production systems within Belorussia and the development of a Belorussian program for large-scale long-term automation of industry. This is not, as before, a program on robotization as before (which is only one means of resolving the task) but on on large-scale automation and this is to be the point of application of all involved forces. As we know, on the one hand, the efforts of both the central and republic organizations were until recently concentrated in this area but on the other hand, they seemed to be on different planes and came together only through sheer coincidence.

[G. Khutsky] This is probably one of the reasons that existing and operating FMS systems have seldom turned out to be flexible in the pure sense. We studied 24 flexible systems presently used in metal-working operations. Every one of them that we saw had the one main feature of FMS: the ability to produce a wide range of parts without changing tools. However, with their lack of other FMS attributes such as automated auxiliary and monitoring operations, the use of robotics, of control equipment and sophisticated transport and storage equipment, these sections could not really be called automated production systems. Finally, not a single one of them was made according to the principle of operator-free technology for even one shift of work, not to mention round-the-clock operation.

[Moderator] In this light, I would like to know whether these FMS systems would be "ideal" model automated systems to imitate without reservation and just what is the ideal system. It seems that a single common name for this phenomenon has still not been found. People talk about FMS (flexible automated production), GPS (flexible production systems) and ATK (automated technological complexes)...

[D. Gorlanov] You are right. Even the specialists still do not have a unified terminology but the problem does not lie in that but in the fact that the approach taken to large-scale automation of machine tool production still does not in many areas coincide in related ministries. The Interinstitutional Coordinating Council of the Soviet machine building ministries has still not, for example, prepared a coherent technical policy on this problem. The Ministry of machine Tools, whose task is to establish a single approach, has still not assigned its own plants and institutions a concrete task.

[Moderator] Then why can't those of us present at this table assign ourselves the task of creating a hypothetical FMS? Let us suppose that we have an open choice of technical resources. We decide whether we want to build a new production system or just redesign an existing factory to be flexible. Then we must examine the factory, determine whether or not it is ready to undergo such a project, distribute design orders and then calculate the economic results. But as we begin, we run into the old problem of terminology. What are we going to call our flexible automated production?

[A. Myasnikov] According to the task that the Interinstitutional Council assigned to Granat, the concepts and terminology already formulated by the specialists of our industry have been systematized. They are used as "working" formulations. The lower structural cells of a flexible production system consist of three generations of flexible production modules. The first



generation is single NC machines and automated devices for loading blanks and removing finished products. The second generation of flexible production modules should furthermore automate tool changing and waste removal. The third generation adds automated measurement and monitoring equipment to the process of machining and assembly as well as diagnosis of defects and malfunctions.

The next stage is flexible production sections that, in relation to the type of modules they contain, are also divided into three levels. For example, a third-level flexible production section is a set of flexible modules (most of which are third-generation modules) and technological equipment connected by an automated transport and storage system and automated tool support system. An automatic system synchronizes the work of the equipment and controls all of the production processes and this makes it possible to switch over to the production of a new item.

Finally, FMS also includes highly-automated production units (shop or plant) made up of flexible production sections and sections for automated technological preparation of production. Therefore, every typical module should have its own control system that allows it to work individually or as part of the overall plant FMS.

[Moderator] Let us now try to figure out which plants are technically ready to be converted to FMS. Let us take, for example, the Minsk Refrigerator Factory, the reconstruction of which was recently described in our journal. It seems to be a modern and advanced operation but it still cannot accommodate the introduction of FMS. It only uses individual manipulators and robotic complexes. Why is this? Perhaps we can "help" this plant?

[D. Gorlanov] I think that this plant does not need our help. Refrigerators are manufactured by mass production which does not require flexible automated systems. They have a fully sufficient number of automated aggregate lines. Such lines have already been used successfully for a long time at this plant. The same is also true of plants of the Ministry of Automated Industry the Ministry of Agricultural Machinery that are turning out production series reaching into the thousands and millions of units. The other point is that it should be possible to rearrange these lines. This is also a form of flexible production but only to a certain extent.

[V. Goryushkin] It may sound like a paradox but flexible production should also be rigid. I can say outright that a bicycle factory starting the production of a new model hardly needs to produce meter-long shafts that weigh as much as hundreds of kilograms. It is obvious that the manipulator grips will be flexible and should be limited within bounds of, let us say, a few tenths of a gram or millimeters. Like excessive strength, excessive flexibility can be unnecessarily costly.

[D. Gorlanov] Another matter is experimental production where it is necessary to quickly make several variants of parts for just one purpose. Let us say that today we need a chamfered shaft, a grooved one tomorrow and a splined one the day after tomorrow. Or let us look at a plant producing consumer goods



such a shoes, clothes, belts, ties and household items which cannot be sold easily not due to poor quality but only because of obsolete forms.

In such a case, we must create a totally new form of production based on other technological and organizational principles. Because we do not consider these areas to be anything more than secondary in importance we do not deal with them very seriously and there are no standard solutions but in the machine tool industry there are already many such designs.

[Moderator] I am reminded of your speech at the conference in which said that it takes 0.3-2 million rubles and 3-4 years to create an FMS section. A shop-level FMS requires 6-8 years and as much as 8 million rubles. These are not small figures. These costs can only be returned under conditions of large-lot production and mass-production. You say that FMS is more useful for small-lot production and even in experimental production where parts are produced singly. Is that not a contradiction? In such a case, it would take to long to recover the investment costs.

[D. Gorlanov] Experimental production today can be carried out by practically any large factory that has its own design bureau. The process of creating a new machine is a very long one. Thousands of new parts must be designed individually. The technology for the new machine must be developed and manufactured in a special shop manned by highly-skilled machine operators. The machine is then assembled from these parts and it might then be found that it doesn't work. Everything has to be done all over again. This is not at all the exception but more of a normal phenomenon in the creation of new machinery. That is why the process of testing, improvement and finishing takes years. For this reason, traditional industry cannot get anywhere.

Let us now suppose that in an experimental shop computer-aided design is set, the technological preparation is carried out, flexible production and a control system are created and a data bank is formed. All we then have to do is assign the technological specifications to produced a finished part of any design in a given amount of time. The savings here is the result of the reduced amount of time it takes to turn out the new product. Therefore, two or three persons can do this in the place of large design and technological bureaus.

[V. Goryushkin] Let me add that both Soviet and foreign specialists agree that 75-80 percent of the production in the machine tool industry is small-lot and individual production while only 20 percent is large-lot or mass production.

The second point is what sort of work do designers and technicians perform now? Designers draw blueprints and technicians "write" the technical process which sometimes consists of 10-20 or more operations. Furthermore, every operation requires a blueprint for the workers to follow and every operation must also include simple explanations. The technical process is an entire volume in itself.

And the complexity of parts is growing...At one time, an iron consisted of just three parts while they now have more than a hundred. If we continue to

work in this manner, it will take 5 years to build our factories and the number of technicians will grow exponentially. Where today there are 15 people, 150-200 will later be needed.

[D. Gorlanov] Let us now look at the modern experimental shop. I worked in such a shop for several years and know it well. This is a factory within a factory! This has equipment for everything: casting shops, galvanizing and blank forming shops, lathes and grinding equipment and a stamping shop. Perhaps some of these facilities are used once every 10 years but how could we manage without them? The use coefficient is wretched. Flexible production allows to considerably reduce such "above standard" resources.

[Moderator] Let us suppose that we have come up with a plant whose technical level can allow the building of an FMS. We still must deal with, let us say, psychological and economic factors. Here is just one example. In a project that Granat specialists worked out for the designing, scheduled building and technical and economic justification of flexible automated production, it is said that "calculations of the technical and economic indicators should correspond to the 'Methodology for determining the economic efficiency and use in the national economy of new technology, inventions and rationalization proposals' confirmed by the USSR State Committee on Science and Technology and the State Committee on Inventions in 1977". Several years ago, there was much criticism of this methodology because it did not make it possible to objectively assess the efficiency of using even individual robots since it did not consider many of the social consequences of this process. We know that FMS is much more complex...As many of the conference speeches indicated, it sometimes takes years to recover the costs of flexible production. It is understandable that in the many processes involving hard or dangerous working conditions, we do waste time making them safer because in our country, we do not scrimp when it comes to human health. But who voluntarily decides to introduce costly FMS where the working conditions are quite good, where the plan is being fulfilled and where, as they say, "money does not drip from up top"? What kind of arguments can you make for FMS? Viktor Ivanovich, you have worked abroad for a long time and studied the creation of FMS. What have you learned from foreign practices?

[V. Goryushkin] Let us recall how many of us have in movie theaters, literature and editorials seen references to ruined equipment that has gone to scrap rather than into planned production. Unfortunately, this is a matter not only of poor management bungling. It is taking longer and longer to create new equipment which on the other hand is becoming obsolete faster. The disgrace of these "scissors" will gradually be reduced. If we consider the amount of time it takes to for equipment to be designed, created and grow obsolete, we see that we can produce a finished machine on new equipment in only two years. Then we can make a new but what kind? The unpredictability of the "orders portfolio" leaves us no alternatives but this problem can only be solved by FMS.

Therefore, they simply figure abroad that a firm which does nothing today to create FMS will not be competitive in 10 years time. I am convinced that under Soviet conditions, FMS is to be introduced when it will not have a negative effect. This is why.

At the conference, one poor comparison for us was introduced. The Vityaz television has about 100 stamped parts. A foreign firm has managed to produce a similar television with 5 unified parts. This is not because the designers in Vitebsk are inferior in any way. It is just that in this case the designers were oriented toward traditional technology while their foreign counterparts were using flexible technology. Therefore, hundreds of stamp operators were having to work where a couple of automated machines and a few tool-setters would have managed quite well. The present industrial structure grew more complicated many years ago when the problem of automation had still not emerged. This is why it has so many stages, operations and high degree of surplus information that is processed during manufacturing.

Flexible technology is revolutionizing industry since it demands that designers work to achieve the maximum degree of simplicity, rational design and a manufacturing technology with few steps. Here the labor-intensiveness, costs and simplicity are what in the final count determine the item's reliability and durability.

[D. Gorlanov] The habit of creating a reserve for future use is unfortunately found not only among suppliers but designers and technologists as well. They strive to make a part stronger and more reliable. In itself, this is a praiseworthy desire but they sometimes make a product too strong so that it will not, as they say, break. It is another matter altogether if the product is too strong or reliable. I have no desire to impugn their professional competence. This is more a matter of human psychology and the desire to oneself against unforeseen circumstances. In orienting ourselves toward FMS, we must break out of this psychology. A part should be as simple and efficient as possible, without any unnecessary strength or reliability. In this, we can be helped by computers or the be more exact, computer-aided design systems.

Let us now consider economic efficiency. Let us take the example of a stamp operator or press operator's work place. These cost a plant about 2500 rubles per year. Our PF-202 robot for the same operation costs 9000 rubles. As we know, it still requires loading, receiving and orienting equipment and then a control system to unite it all into a single complex.

[Moderator] At the conference, we were shown still other examples in which a robot replacing one machine operator was accompanied by two or three workers to maintain the precision mechanical, hydraulic, pneumatic and electronic systems. In a word, the use of a robot turned out to be inconvenient. On the other hand, robot production is increasing steadily. Does this mean that we are working ourselves into losses?

[D. Gorlanov] What we are doing for now is calculating the efficiency of robotics with the help of beginning arithmetic. We are trying to compare the cost of a robot which includes the design, research, cost of manufacturing, materials and components with the annual wages of a worker. Simple logic would dictate that we must also consider the cost of training, not only technical training but also middle school and even kindergarten education.

But this is already in the realm of "higher mathematics" that we will for now leave out of our calculations.

The use of unified robots is actually inconvenient because we have to use them in greater numbers and on a large scale. Meanwhile, flexible production systems is large scale automation too but in this area we also lose ourselves at times. Today the degree of industrial automation is determined by the degree to which manual labor is mechanized. If it exceeds 70 percent, we say that the industry is comprehensively automated even if this is not at all an appropriate term. In as much as I know, at the Experimental Scientific-Research Institute of Machine Tools, the chief machine tool institute, a new methodology has been worked out for assessing the economic efficiency of flexible automated industry. We have not tied of waiting.

[Moderator] Since we are moving on to a new subject, it is important to know what sort of problems we must resolve. Will they be principal theoretical problems or purely technical complications?

[A. Myasnikov] We have our theoretical prerequisites. We know what FMS should look like and what functions it should take in industry, what technical resources are necessary for every function and what the requirements on it are.

Therefore, I think that there are two problems here, technical and organizational, and the second is more important because the solving of a technical problem requires very close cooperation between all of the designers and producers.

Capital investments will be very large. There are also many people working to develop and introduce FMS and more than enough complexes and nuances to production. The task is to "tie together" all of the executors of this task, and at minimal cost and maximum effect. We must create a system that makes every participant do his part of the work on time and with the necessary quality. Therefore, we must reorganize and probably reorganize more than just the shop structure.

How are FMS components now created? The machines are made at one plant, while another produces the robots and a third makes the control system. As often as not, all three plants can belong to different ministries whereas FMS requires the resolution of all of these problems within a single complex.

[Moderator] We can introduce many examples in which efforts to coordinate the work of several different institutions in the production of even the simplest items ended sadly. This was always a matter of cooperation at the highest levels.

[A. Myasnikov] We have already had this experience in Leningrad. I witnessed how Leningrad solved the problems of cooperative production of one of the parts to a control complex. They managed to work things out without any

ministerial interference and adjusted one of the local plants to produce items needed in the entire region. Therefore, we can limit the manufacture of fittings, uncomplicated technical equipment and regulate the exchange of information.

[V. Sobolev] Let me tell you a little more about the experiences in Leningrad. In the Leningrad region, work in this area was carried out under the leadership of an interinstitutional coordinating council created within the Leningrad Oblast CPSU Committee (as you see, we also took this path). The directors of every plant participating in the program were ordered to develop their own concept for FMS and to defend it at a council meeting. This was followed by practical work. Within the head council and every plant, 18 sections were created to deal with different directions that continued to hinder their direct work.

Therefore, we were able to solve three problems at once. First of all, all sections received full information on what is being in this area both within the USSR and abroad. Second, we were able to regulate interindustrial cooperation in the manufacture of equipment and fittings. And finally, we solved the main problem of financing, reconstructing and re-equipping plants. Resources are appropriated as we know from the funds of the chief ministries and all of this has been worked out with territorial organs. Thanks to the concentration of the efforts of Union ministries and local organs, the People in Leningrad have planned to introduce within the next few years 16 integrated processes and 23 FMS to plants of the city and oblast. Some of these systems are already in operation. What they have in mind is FMS in its "pure form" without any reservations.

[Moderator] This means the organizational problems can be solved but what sort of technical difficulties have you encountered?

[G. Khutsky] What seems to be a secondary but frequent problem is chip removal. Under a flexible production system and "operator-free technology", it turns out that the crushing and removal of chips is very important. An inability to solve this problem and the lack of automated control are the chief factors that prevent us from reducing human involvement in Soviet-made flexible production systems. Many methods and devices have been proposed: special tool geometry, communication of vibration support, the feeding of lubricant and coolant liquids under great pressure and interrupted feed...However, such diversity attests to the lack of a single reliable and universal design.

And there is the problem of reliability. Practically all "mechanical" elements of a flexible production system were for a long time known for how they could be united into a single system. They are sufficiently well made and reliable but the electronic and electrical parts do still malfunction too often. If 99 elements in the usual circuit are good but the hundredth has a malfunction, the entire circuit is broken and in our case, the FMS will then cease to work.

From investigation, we found that, out of the 200 domestic robot models available, the developers of the first integrated systems could not find one

that they could use in their flexible production system so they had to design one themselves that had the features they needed.

There are also some theoretical problems here. How, for example, are we to quantitatively determine the flexibility of automated production? Actually, if we can calculate and compare the output capacity of the equipment, the degree of its mechanization and automation, investment return and usefulness, then why can't we also establish its degree of flexibility? In order to be able to compare its level is, let us say, light industry and the machine tools industry, in metal working and galvanizing. This is not capriciousness at all, but is necessary in order to determine the power of computer complexes or the carrying capacity of lines of communication. As far as I know, this problem has been successfully resolved in Vitebsk under the leadership of one of those present at this discussion.

[V. Goryushkin] And in your opinion, what is easier to automate: the simplest lathe or a multipositional machining aggregate? At first glance, it would seem that the lathe is easier to automate but it turns out that this is not the case because the parts to be machined in an aggregate require extra attachments and satellites. They are all standardized and identical. This means that in order for them to be manufactured, it is necessary to make a transport system and storage and this in itself already constitutes a full cycle of automation that "ties together" in one unit the entire production technology.

All of the technical solutions that have been worked out today for the same robots or control systems are unfortunately too narrowly specialized. They require further adaptation to the given type of production. Let us suppose that we have a machining tool and a corresponding robot. It costs as much again to unite these two components as it did to buy or make them. In general, technology in modern industry has acquired primary value. It is no coincidence that construction secrets are never shared anywhere. A new item, be it an airplane or an automobile is shown at an international exhibit where it can be seen and studied. This is even calculated. A rival having decided to "draw" the construction will need to spend time studying it. As long as he has to do this, he will remain hopelessly behind.

Any firm keeps the finer details of its production a secret or it charges a substantial sum for a license. It is no coincidence that this is called "know-how". He says, I know how but I won't say for free. This brings us to the main question which is technology. Without detailed preparation of the production technology, no one will succeed in introducing FMS.

[Moderator] This is probably the right time to get back to the experience of the Granat Association which has developed a standard position on the building and stages of creating FMS. This is also its own form of technology.

[A. Myasnikov] FMS is created in the following stages: technical and economic justification, development of a technical principle, creation of a design and working documentation, realization of the design and activation of production.



The design is worked out in its entirety at the plant but it can only gradually be brought into operation, first on the level of a section, then the shop and finally on the level of the entire plant.

Responsibility for the creation of the design at the shop and plant level usually rests with design institutes. A plant is unable to do this itself. Therefore, one of the plant directors, usually no one lower than the chief engineer is responsible for the realization of the design. The material and technical support is provided by branch services by means of large-scale supplies called for by the design documentation.

The stage of the realization of the design includes the creation and adjustment of technical resources for manufacturing, arrangement of standard equipment and computer technology, selection of special technological equipment and monitoring and measurement apparatus, construction and assembly work and cadre training.

[Moderator] As it was noted at the conference, the design can be realized in 3-4 years but as we know, that is an ideal scenario. Since we have been talking, we discovered that many FMS components are far from ideal: even computer technology sometimes lets you down and robots are too few and there is still no single approach...

[G. Khutsky] I think that I would not be insulting anyone here if I suggest that our health is not ideal. This does not prevent us from working normally. To create flexible automated production today we have everything we need such as metal-cutting machines, transport and storage systems, orientation and positioning devices, machine fittings, control and measurement equipment and computer control complexes. Even if something is still not perfect, that is natural. After all, the attainment of perfection is an endless process.

It must also be said that the differences in the indicators of domestic and foreign flexible production systems are explained not only by the difference in their technical level but also by the differences in their opinions, approaches and the suitability of their use. On the whole, Soviet practice reflects all of the concepts and advanced technological solutions of flexible production systems. The best examples of Soviet flexible production systems meet world standards for their level of automation, flexibility, reliability and design. The other point is that there are still relatively few of them. Therefore, in my opinion, we must not waste time or wait but start working on achieving an "ideal flexible production system".

[Moderator] And finally, the last point: I would like to hear a prognosis for at least the coming decade.

[V. Goryushkin] I am deeply convinced that within the next 10 years flexible production systems in our plants will become as commonplace as NC machines are today.

[Moderator] Please allow me to thank you for being here today and wish you success in your work.

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## INDUSTRY PLANNING AND ECONOMICS

### DEVELOPMENT OF AUTOMATION TECHNOLOGY LACKS COORDINATION

Moscow EKONOMICHESKAYA GAZETA in Russian No 7, Feb 85 p 18

[Article by L. Volkevich, doctor of technical sciences and chairman of the VSNTU [All-Union Council of Scientific and Technical Associations] Committee on Automation and Mechanization of Industrial Processes, and A. Shatilov, candidate of technical sciences and member of the committee presidium: "New Technologies for Industry: Robots and Equipment"]

[Text] An advantage in industrial automation and one of its most effective elements is general robotics. This year's plan calls for a substantial increase in the production of flexible automated production modules and systems. Robot production will increase by 14 percent to a figure of 14,300 units.

However, do automated helpmates in industry always work at their full capacity, radically reduce manual labor and quickly justify their costs? According to data provided by the VSNTU Committee on Automation and Mechanization of Industrial Processes, plants in many cases must be satisfied with only incomplete results of roboticization and this is due to the lack of a full set of robotic technological gear.

This is actually the equipment that directly "materializes" the technological process and to the greatest degree determines product quality, the flexibility of production and its economy. At the same time, 80 percent of the tools and instruments used to attach this equipment and objects of production are manual. In other words, every part in every operation must be set into place by workers and then removed manually. Furthermore, in mass production as much as 80 percent of the attachments are specifically used for just one article or one strictly defined operation.

According to calculations on the introduction into production a new article of average complexity, an average of 12,000 units of diverse technological attachments are required and 90 percent of that must be newly designed and manufactured. Special attachments can only be created after the necessary constructions and technical processes are worked out. Therefore, the time needed to bring a new item into production can sometimes be as much as a few years.

The amount of use received by special attachments is relatively low and they most often go into storage where they become obsolete much faster than they wear out. According to the findings of our committee, the total stock of just these specialized machine attachments amounts to more than 100 million pieces while each year more than 14 million units are written off as useless although only one-fourth of these are actually physically worn-out.

In our opinion, this problem can be solved by switching of specialized technological attachments to modified ones and from manual to automated.

In its own time, the organization of industrial cooperation on the production of universal fixtures played a progressive role. The centralized manufacture of these continues to grow and in the past 8 years has grown 2.5 times to exceed 20 million rubles in value. However, this is extremely insufficient in terms of both quality and quantity.

Today, not one of the previously famous systems of reversible and adjustable attachments including universal fixtures can satisfy today's requirements on strength and labor-intensiveness. New ideas and designs are necessary. In this direction, leading plants and organizations are not waiting on orders from "higher up" but are taking their own initiative.

At the Lenpoligrafmash Plant, the use of adjustable group attachments (15 base varieties) has made it possible to introduce 14 continuous-group metal-working lines and stop using 10,000 different special attachments. The time spent on technological preparation for production has been cut in half and the productivity of machine operators has been increased 25 percent.

At the Kharkov Tekhosnastka Institute, the Ministry of Machine Tool Industries is working on the development of a set of universal fixtures and adjustable attachments that are more highly automated, very precise and reliable. The Moscow Higher School of Technology imeni N.E. Bauman worked with the Moscow Automobile Factory imeni I.A. Likhachev [ZIL] and Orgstankinprom to create designs for precision multi-purpose attachments for bodies of rotation. One set of these can save tons of steel.

There are still other examples but they are unfortunately just isolated ones. This work is not directed or coordinated by the ministries. Hundreds and thousands of plants that one way or another must be equipped with new technology continue to follow the old and tried ways. In other words, just as before, they develop and then make their own special manual attachments with no regard for time or costs.

Differences in opinion about this problem have even been reflected in standardization. For a long time, Gosstandart did not work to create a unified system but to establish for all time a multitude of partial and often repetitive technical designs. There are presently over 4000 GOST standards on just attachments alone. Aside from this, many documents directly related to attachments are dispersed in various systems (ESTPP, KSUKP [not further identified], computer-aided design, etc.). How are producers supposed to make any sense out of this?

Technical standards on the selection, design, manufacture, operation and repair of attachments are completely unsatisfactory. Even other scientific and technical documentation is in extremely low supply and this includes typical engineering calculations (such as those done by computer), albums, design catalogs and reference material.

The problems in the perfection of technological attachments have generally shot out of the field of view of the GKNT [not further identified]. Therefore, there is unfortunately no need to talk about a single technological policy in any one area.

Such an approach is no longer permissible with the present intensification of production though the use of advanced technology, large-scale mechanization and automation. What is required is a single governmental approach based on the creation of highly-specialized and centralized production of advanced technological attachments and an orientation toward flexible multipurpose automated variety.

Finally, it seems to be most tempting of all to first create a network of specialized plants and to organize centralized production of adjustable technological attachments in numbers that would satisfy the massive demand. The distribution of this attachments through the territorial offices of USSR Gosnab could also be centralized along with the directed large-scale equipment of plants under the direction of that organization. However, this requires additional material and labor resources.

It would be more feasible and realistic to use another variant in which at all stages the necessary forces and means could be obtained through the savings gained from rationalizing the creation and use of attachments.

It is necessary to systematize all of the advanced universal adjustable technological attachments that have been created in our country and abroad. For this purpose we can organize a series of specialized exhibits on basic technological processes (such as pressure treatment, cutting, welding, assembly, etc.) or types of articles and if possible, comparative tests and competitions. In the case of the most promising technological designs, it would also be useful to publish the proper amount of technical documentation including catalogs, albums and reference materials.

At the same time, we need to work and and distribute to a wide circle of plants the necessary standard methodological documentation, especially that concerning the problems of forming sets of technological attachments, best synthesizing them, (using computers and computer-aided design) and the conditions of efficient operation and repair. Progressive experiences in the conversion to progressive forms of attachments are worth special attention.

The gain from less time spent assimilating new products, in labor-intensiveness and the cost of technological equipment makes it possible to broaden centralized cooperative production of universal adjustable technological attachments starting within the industry itself and then on an interindustrial level. The most important factor here is the psychological breakthrough, the consciousness of the fact that any slogans of the struggle

for progressive technology can become a real force only if they are materialized through progressive technological equipment.

It is understood that this entire process relies on a single strategy and long-term planning on the part of USSR Gosplan and GKNT and first of all through the development and realization of the necessary comprehensive guided program.

The creation and full introduction of universal adjustable technological attachments is at this time one of the most important factors deciding the fulfillment of the tasks of flexible automated production.

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INDUSTRY PLANNING AND ECONOMICS

ACCOUNT OF ACTUAL CONDITIONS UNDER ECONOMIC EXPERIMENT

Establishing Innovative Production Conditions

Moscow LENINSKOYE ZNAMYA in Russian 12 Feb 85 p 2

[Article by Ye. Smelov and L. Lin: "Steps of the Experiment: 1. Along New Lines of Orientation"]

[Text] Beginning with the new year, as is well known, some more branches of the national economy joined in the large-scale economic experiment. And their number includes 50 enterprises of Moscow Oblast. For this reason, the practice of the management of collectives that have already worked for a year in the conditions of the expansion of their independence acquires increasingly broad public interest.

The "Moskovskiy Rabochiy" Publishing House of the Moscow Oblast Committee and the Moscow City Committee of the CPSU is preparing a series of pamphlets [under the general title of] "The Economic Experiment" for publication. The authors of one of them, the general manager of the Elektrostal'-tyazhmash [Electric Steel Heavy Machinery] Production Association, the laureate of the State Prize of the USSR, Ye. S. Smelov, and the chief of the Department of Industry and Transportation of the newspaper LENINSKOYE ZNAMYA, L. I. Lin, tell how the economic search at Elektrostal'-tyazhmash, the largest machine building enterprise of the oblast, was prepared and realized. Taking into account the special topicality of the experience of the conduct of a large-scale experiment on the basis of the intensive development of scientific-technical progress, the editors today begin the publication of individual chapters from the pamphlet "Glavnoye napravleniye" [The Main Direction], which will appear in print during the first quarter of 1985.

By no means everyone knows what of itself a modern unit for the production of steel pipes represents. For this reason, we will state at once that this is a complex of equipment weighing 5,000, 10,000 and at times 20,000 tons. In order to move it, several heavy-weight railway trains are required. And in order to place this equipment, it is necessary to construct a shop with an area

of tens of thousands of square meters. Such is the output of the Elektrostal' tyazhmash Production Association--the only enterprise in the country which plans, manufactures and supplies pipe-rolling units and electric pipe-welding machines to metallurgical plants.

More than 64 percent of all steel pipes in the country are produced in mills with the trade mark of EZTM [Order of Lenin Elektrostal' Heavy Machinery Plant]. So that if only metallurgists are directly acquainted with the output of the electric steel machine builders, hardly anyone could get along without the articles produced on their equipment. After all, without pipes neither water-pipes nor central heating, neither the bicycle nor the automobile. . . are thinkable. Very likely, one could not enumerate all the spheres of the application of steel pipes, there is a great multitude of them.

The main brain center of the association is its scientific-research, planning and design, and technological institute. In it work 2,500 persons, including 3 doctors and 42 candidates of technical sciences, 38 specialists of the association have been awarded Lenin and State Prizes.

The output of the association is distinguished by a high technical level and originality of design: 1,305 machines and mechanisms with the trade mark of EZTM have been protected with certificates of authorship, 175 patents protect the products of the electric steel enterprise on the territory of England, Italy, India, Canada, the United States, France, Sweden, Japan, and the Federal Republic of Germany. A total of 39 license agreements have already been concluded for the products of the association. And the share of its products with the State Emblem of Quality comes to 33 percent of the total production volume.

One of the most important directions of the increase of the efficiency of the use of metal in the national economy is the broad application of technological processes and equipment, which guarantee the output of rolled products of economical types that approximate in their forms and dimensions the finished components. A significant role in the execution of this program is assigned to the electric steel association. Its collective has been entrusted to plan and secure, in the course of the 11th Five-Year-Plan, the complete delivery of 43 mills of automated plants and production lines for the output of various parts through the rolling method. Several such units have already been assembled and are going through operating tests. The main tasks which the electric steel workers are solving during the creation of such machines are the increase in the coefficient of metal use, the increase in the reliability and durability of the parts obtained through the rolling method, and the reduction of labor intensiveness of their manufacture.

The execution of the entire complex of work operations in regard to the production, at the EZTM, of such equipment will secure the output of 1,250,000 tons of blanks for machine building components and will make it possible to save 140,000 tons of metal.

However, with all of the positive results of the development of production at the EZTM, there is still a shortage of the equipment being produced by the association. To a significant extent, this is explained by the fact that creative

possibilities of the collective are not fully utilized. There are several reasons for this: The imperfection of the practice of planning and the stimulation of production, the shortcomings of material-technical supply, and, of course, internal disorders--the lagging behind of stockpiling production, miscalculations in labor organization, and violations of labor and execution discipline. Life has shown that, to a considerable extent, these reasons, on the one hand, are the result of the insufficient economic independence of the enterprise, and, on the other, the result of weak responsibility on the part of the collective for the final results of production. The large-scale economic experiment is precisely aimed at overcoming these shortcomings. Its conditions, as is well known, provide for the expansion of the rights of the enterprises and the strengthening of their responsibility for the execution of the orders of the national economy, which, in its turn, should guarantee the combination of the interests of the state, the labor collective and the individual worker.

The entire preparation for work in the new conditions had to be carried out in less than half a year. To coordinate the reorganization of planning, management and incentive in accordance with the conditions of the large-scale experiment, a special permanently operating commission was formed by order for the association. Its composition included the most competent and authoritative managers and specialists of all functional services of the association, as well as representatives of the party and other public organizations.

As of 1 January 1984, a developed plan of organizational measures became the basis of all the work in regard to preparation and execution. It represented in itself a concrete program, providing what must be done, by what date, and by whom. Being guided by this document, materials were prepared in the association and sent to all the subdivisions of the enterprise, disclosing the content of the economic experiment and the tasks which will have to be solved by the collectives of the shops and departments, sectors and brigades in the new conditions. In accordance with a specially developed program, studies for the managers of subdivisions were organized, which were devoted to the study of the methodological instructions of the instructional materials. It is necessary to say that the thorough penetration of the managers and specialists into the essence of the experiment already during the first stage of its preparation was absolutely necessary. Because it was necessary simultaneously to conduct work in regard to changing the system of assessing the activity of the shop and department collectives and develop new provisions for material incentives, oriented on the strict fulfillment of contract obligations.

The association obtained the plan for 1984 in terms of the basic economic indicators on 14 September, one and half months earlier than in previous years. And still earlier, in June, the enumeration of the basic products list of the association--rolling mill equipment which had to be manufactured in 1984--was made up. However, it must be said at once that even these terms in the conditions of individual production are far from optimal. Because the time for the preparation and orientation of production and the development of the technical documentation remains insufficient. And this, in its turn, does not permit the timely ordering of articles and materials needed for completion in precise accordance with the requirements.

Nevertheless, as we have already said above, the plan indicators and the economic norms for 1984 were obtained significantly earlier than before. And this



made it possible, still before the coming of the year being planned, to discuss, in a matter-of-fact way and with figures available, at meetings of the labor collectives, the tasks which had to be solved. In so doing, the main attention was devoted to the strategy and tactics for the execution of production deliveries in accordance with the contracts.

The collectives of all technical services and shops were drawn into active participation in the preparatory work that developed. Every subdivision received increased--by comparison with the preceding years--tasks with respect to the reduction of labor intensiveness, the decrease of production expenditures and the necessary number of workers. The review and competition for the investigation and utilization of reserves for the growth of labor productivity, which have begun in the association, were precisely directed aimed at these goals.

The preparation of the collective for participation in the economic experiment became the most important business of the party organization of the association. The party committee headed the work on the ideological securing of the reorganization that had begun. First of all, it was necessary to make everyone conscious of the goals and tasks of the experiment, to clearly and intelligibly formulate its basic content with respect to the concrete conditions of the Elektrostal'tyazhmash Production Association.

The studies in the system of political and economic education in 1983 began with the study of the goals, tasks and conditions of the large-scale experiment. Discussions, political information, and lecture cycles were devoted to these subjects. In order for this work to produce maximum utility, the party committee conducted seminars for propagandists, at which leading specialists of the association spoke. They began to organize days of the economist every quarter, when the workers of the economic services of the enterprise speak to the workers on the subject of the course of the preparation of the collective for work within the framework of the large-scale experiment.

During this stage of preparation, the main attention was devoted to visual agitation. Slogans and posters devoted to the experiment called upon all workers of the association to take part in the reorganization that had begun. On the territory of the enterprise the colorful appeal appeared: "To the Economic Experiment--the Highest Discipline, Organization and Order!" And here, written in large letters, a poster explained: "The goal of the experiment: The unconditional fulfillment of contract obligations with respect to production deliveries; the attainment of the highest labor productivity with minimal expenditures for production; the creation and manufacture of highly-efficient equipment; and the increase of the material interest of the workers, the engineering and technical personnel and employees in the achievement of high final production results."

Every day thousands of workers of the association walked past this poster, and it is not surprising that after several days everyone at the enterprise knew the main thing--why the experiment is being undertaken. For this reason, a natural and to all understandable response to the tasks assigned to the collective was the appeal of the progressive brigade of the Assembly Shop No 5, managed by the communist N. P. Kechin: "Contracts--On Time, the Highest Productivity, and Minimal Expenditures." Thus, the ideas of the experiment,

already during the stage of its preparation, became embodied in the initiative of workers.

A poster put out in the association in an edition of several hundred copies, in accessible form and at the same time in sufficient detail, provided information about the conditions of the economic experiment and about what it promises for the enterprise and every one of its workers. Precisely, point by point, the poster also talked about the expansion of the independence of the enterprise and the wage and incentive funds and about how, in the new conditions, the economic activity of the association will be assessed and what indicators influence the dimensions of the incentive funds. In addition, every worker received a specially published booklet: "Pamyatka" [Booklet] on the conditions of the experiment.

The model stands "Our Shop in the Economic Experiment", established in every shop, have performed a valuable service in the cause of associating all the toilers of the association with participation in the experiment. On seven professionally mounted plane survey sheets of such a stand, the plan tasks for 1984 and the course of their fulfillment are represented, as well as the basic obligations with respect to contracts and job authorizations and orders, the tasks with respect to the increase of labor productivity, the reduction of production cost, and the basic measures aimed at the execution of these tasks. A separate plane survey sheet is devoted to each of the three economic stimulation funds and the wage fund. Moreover, it is indicated how these funds are formed and how they must be expended. Thus, a model stand conveys a complete idea about the conditions of the experiment.

The significance of such a theoretical and psychological preparation of people is difficult to overestimate. It helped the workers of all levels to become sufficiently receptive to the ideas of the impending experiment, to critically assess the customary practice of management, and in some degree to change the orientation in accordance with the new economic criteria and tasks.

The party committee of the enterprise showed great concern about seeing to it that a state and party approach prevail in the responsible work entrusted to the collective of the association in all of its stages. Questions connected with the course of the preparation for the economic experiment were repeatedly reviewed by the party committee. A staff for the control of the reorganization, specially created by the party committee, operated actively.

In November and December, the party meetings that took place in the shops and departments of the association were also devoted to the tasks of the transition to work in the new way. And on 16 December the question about the readiness of the association to conduct the experiment was submitted for discussion of the meeting of the party-economic aktiv.

In its decision, the meeting outlined concrete measures for the completion of the preparatory work. First of all, the task was set to attain an improvement of the balance of the production plan, both in value terms, as well as in terms of labor and material resources. The collective of the association was worried about the fact that, as the result of the increase in average prices permitted during planning, the volume of commodity production in the plan increased by 2.8 million rubles, and the norm for net production--by 1 million. At the

beginning of December, the shortage of workers came to 250 persons, including a more than 10 percent shortage of machine operators for the fulfillment of the plan. Quite a number of unresolved problems still remained in the material-technical guarantee of the annual plan. All of these relapses of previous shortcomings in planning and material-technical supply, of course, complicated the transition to work in accordance with the requirements of the economic experiment. And for this reason, significant efforts of the management of the association, not only to the final days of 1983 but also in the course of the following year, were expended to overcome shortcomings of a similar kind in planning, many of which can be attributed to natural expenses of the transition period.

And although it did not prove possible to observe all necessary initial conditions by the day of the beginning of the experiment, the fact of the impending participation in it itself was conducive to the development, in the collective of the association, of an atmosphere of creative optimism. You see, the economic experiment is not only an important stage of the introduction of new methods of management, aimed at the intensification of our economy, but also an exceedingly responsible process of the elaboration and perfection of these methods and their examination for viability.

#### Productivity, Output, Profits Up

Moscow LENINSKOYE ZNAMYA in Russian 13 Feb 85 p 2

[Article by Ye. Smelov and L. Lin: "Steps of the Experiment: 2. The Main Goal]

[Text] The order of the consumer is the law for the producer. This truth, it would seem, does not require proof. But no means all find it to be an indisputable rule. As is well known, measures to eliminate this chief contradiction in the mutual relations of producer and consumer lay at the basis of the large-scale economic experiment.

For the collective of the Elektrostal'tyazhmash, the problem of the rhythmic fulfillment of the plan in accordance with the assigned products list, the contracts concluded, and the order-vouchers for the delivery of metallurgical equipment was always acute. And above all because this association is an especially tough little nut in the sense of the organization of management. It refers to a type of enterprise with so-called discrete character of production; that is it turns out not a series of identical articles, but a multitude of the most complex machines and aggregates not similar to one another, each one individually or in only a few copies, and the majority of them novelties, designed and manufactured for the first time.

Such a complex production organism reacts especially painfully to any sort of intervention from the outside, not foreseen by anything, unexpected and at times contradictory. Here we have in mind delays in the issue of products list plans, their imbalance with the material-technical and labor resources, failures in the mechanism of production sale, the imperfection of the incentive system, etc. If the intra-firm shortcomings are added to this, such as the lagging behind of the blank factories and the personnel turnover, then it

becomes understandable why during the course of the five-year-plan the association fulfilled the obligations with respect to the delivery contracts unsatisfactorily. Thus, in 1981 the collective coped with deliveries to the extent of 91.4 percent, in 1982--85.1 percent, and in 1983--88.6 percent.

The entry into force of the conditions of the economic experiment at once had a positive influence on the work of the association. Thus, in the first quarter of 1984, Elektrostal'tyazhmash coped with the fulfillment of contract obligations to the extent of 99.5 percent. In so doing, the volume of production sold increased by 3.5 percent, compared with the level attained the year before. The collective fulfilled its counterplan for the growth of labor productivity and the reduction in cost of commodity production. The saving, thanks to the reduction of expenditures, amounted to 342,000 rubles for the quarter. Such reassuring results were the direct consequence of the expansion of the rights of the association and the increase in the responsibility of its collective for the results of the work.

In what did this find concrete expression? If we are to talk about the expansion of rights, it is necessary, first of all, to mention the possibility granted to the association, on the basis of tough standards, to earn incentive funds and to spend them for the encouragement of conscientious labor of workers and specialists and the satisfaction of the vital needs of the collective. As far as the increase of responsibility is concerned, it must be said here, first of all, that the dimensions of the enterprise funds depend directly on the execution of the obligations with respect to delivery contracts. Thus, according to the conditions of the economic experiment, given 100-percent fulfillment of the plan for the sale of production in complete accordance with the obligations in regard to contracts concluded and orders accepted for filling, the material incentive fund increases by 15 percent, which, calculated for 1984, came to 364,000 rubles. However, for every percent of nonfulfillment of contract deliveries, this fund decreases by 3 percent, or by 72,000 rubles. It is natural that such dependence exerted a highly stimulating influence on the strengthening of delivery discipline.

The strict system of daily control over the course of production, which was introduced beginning on 1 January 1984, was a very important factor of the changes that have begun in the enterprise. It made it possible to secure the constant orientation of all subdivisions toward the attainment of final results and to eliminate local and narrowly-departmental aspirations in the work of the shops.

Here is a characteristic example of the positive result of such influence. Whereas by the beginning of every month of the first half of 1983 the provision of the plans of the machine shops for the output of rolling mill equipment with complete semi-finished goods hardly exceeded 20 percent, in the conditions of the experiment this indicator reached 58-59 percent. As a result, there was an improvement in the rhythm of production and an increase in the output of the machine operators.

The creation of a department for contracts and orders in the association played an important role in the whole business of the reorganization. Previously these functions were carried out by the department for marketing. In the

conditions of the economic experiment, the requirements in regard to the method of conducting contract work have essentially changed. This is called forth, above all, by the fact that the terms and periods of delivery (month, quarter) are strictly regulated by statute and by the special conditions of the fulfillment of contract obligations, as well as fund orders corresponding to the established plan of production. For this reason, already during the stage of the preparation of contracts the terms of delivery and the production output plan must be coordinated with the production possibilities of the enterprise. Thus, the new department had to create a single organizational system combining the process of contract registration and production planning. This work is conducted by the collective of the department of contracts and orders jointly with specialists of the information and computer center and other technical services of the enterprise. A system for the organization of contracts on the basis of the analysis of the work load of the limiting resources of the castings and forgings and machine-assembly factories is being tested with the aid of electronic computers. When this process is laid aside, the department of contracts and orders will be able--in the difficult conditions of individual production, even in the absence of technical documentation--to realize the optimal distribution of production, taking into account the production possibilities of the association.

However, even now the new service in many respects is conducive to the regulation of the work in regard to the registration of contracts and orders and thereby essentially strengthens delivery discipline.

The involvement of material resources in economic turnover and the acceleration of the turnover rate of working capital is an important factor in the reduction of expenditures per ruble of commodity production. For this reason, active work has unfolded in the association that is aimed at the reduction of above-normal reserves of commodity stocks. Tasks with respect to the reduction of the residues of raw materials, materials and articles were established by the commercial services. As a result, it proved possible to search out possibilities for the utilization of a large number of fabricated metal products in production, as well as to reduce the residues of finished production, and to sell many physical assets not being utilized in the association. This made it possible to reduce the actual residues of the working capital being standardized by almost 3 million rubles after only 5 months.

The results of the work in 1984 have shown that the conditions of the economic experiment appreciably promote the intensification of production. The volume of production sold during this time with regard to the fulfillment of the delivery obligations came to 98.4 percent of the plan task, which was 9.2 percent higher than the level attained the year before. There was an important improvement in the other indicators as well. Labor productivity increased by 7.2 percent and constituted 100.7 percent of the plan figure. They have begun to make far better use of the production capacities. Profit from industrial activity exceeded the plan profit and increased by almost 2 million rubles for the year. And expenditures per ruble of commodity production decreased by 1.2 percent, while a year ago they were 1.4 percent higher than the plan expenditures. The number of workmen operating a number of machines simultaneously increased by almost 10 percent in the collective.

It is exceedingly characteristic that, with a significant increase in the material incentive fund, it proved possible to secure an outstripping rate of growth of labor productivity by comparison with the rate of increase of the average wage. This indicates that the material interest in highly-productive work in the conditions of the economic experiment is sharply increasing. And this helps the collective to cope with the basic obligations in regard to contracts and supply authorizations--to supply equipment for such important priority projects as the 350/250 quality rolling mill at the electrometallurgy plant Elektrostal', the complex for the production of steering column tubes of the Dnepropetrovsk Plant imeni Karl Libknekht, the calibration mill of the Severskiy Pipe Plant in the Urals, and the 1420 M electric pipe-welding machine of the Khartsyzskiy Plant, at which pipes for cross-country gas pipelines will be produced. In addition, during the past year the association completed large export orders.

In implementing the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures to Accelerate Scientific-Technical Progress in the National Economy", the development of technical proposals and the conduct of necessary pre-planning research for a whole series of important directions were outlined in the association. In particular, the creation of an aggregate for the surfacing of large-diameter pipes and an aggregate for the continuous rolling of 350 pipes is being planned. The conditions of the economic experiment will help to accelerate the realization of these extremely urgent technical programs.

Thus, already the first year of the participation of the Elektrostal'tyazhmash Production Association in the large-scale economic experiment showed that the new conditions are conducive to the strengthening of delivery discipline, the acceleration of the growth of labor productivity, the reduction of expenditures for the output being produced, and the improvement of the use of the capacities. All of this increases production efficiency and, consequently, works to satisfy the interests of our state.

However, in order to make full use of the potential possibilities of the association to increase the efficiency of production through intensive methods, it is necessary to be bolder in developing and perfecting some provisions of the economic experiment, and what is the main thing--securing their strict execution.

Let us take as an example the notorious "tonnage" approach being used in the planning of the production of metallurgical equipment. In the conditions of the economic experiment, the negative influence of such an approach is significantly alleviated. However, the problem is not solved to the end. The thing is that the order established by the new price-lists envisages the preservation of the original price of equipment if, in the process of planning and manufacture and in the presence of unchanged operating possibilities, it became less in terms of mass or, to put it simply, became lighter, but by no more than 20 percent. If this limit is exceeded, a new price is established for the equipment. What will this lead to? Why, to the fact that the enterprise has no economic interest in decreasing, by more than 20 percent, the weight of the equipment being manufactured. Thus, the existing system of planning



in tons remains a factor which limits the interest of the enterprise in reducing the metal intensiveness of production. In the conditions of the economic experiment, the planning of production output in tons and accountability in terms of this indicator have been preserved. That is, as before, if, for example, it proved possible to achieve a two-fold decrease in the mass of a machine, then, in order to fulfill the plan in tons, it is necessary to manufacture another such machine in addition or a machine equivalent to it in terms of weight. The machine builders take the view that this indicator (tonnage) must be preserved only as an accounting indicator, to be used in solving problems of the material-technical supply of production. We must introduce a procedure, according to which the wholesale prices for rolling mill equipment of individual execution are ultimately established in the stage of the confirmation of the technical task. When the mass of the equipment is lowered in the process of manufacturing planning, the price must not be changed.

At present quite a few proposals are being received by various economic organs concerning the insertion of such elaborations, changes, supplements and refinements in the conditions of the large-scale economic experiment. And this is indicative of the fact that an economic search is proceeding actively.

To observe already developed conditions and provisions more precisely and punctually, in our view, is especially important. And, above all, we must see to it that the orders for the delivery of production in accordance with the volumes of production established by the five-year-plan for such associations as Elektrostal'tyazhmash are given out precisely within the terms provided for by the "Special Conditions for the Delivery of Heavy, Transport, Construction, and Road Machine Building Products. . ." And the products list for the annual plans must without fail be formed in accordance with the nominal list of equipment and the orders issued. For the time being, everything is far from in order in this exceptionally important matter. For example, during the formation of the products list plan of the association for 1985, extremely important changes had to be introduced in it. Let us say, the products list plan was received in March. In the enterprise they began to work with it. Suddenly, a month and a half later, they change it: They remove more than 3,000 tons of equipment from the plan and include approximately as many other machines in it. As a result, the late formation of the products list plans and the delay of fund orders created considerable difficulties in the preparation of production and the sending in of applications for material-technical supply of production in 1985.

However, we would like to believe that these shortcomings, too, will be overcome.

#### Reinvestment in Capital Equipment

Moscow LENINSKOYE ZNAMYA in Russian Feb 14 85 p 2

[Article by Ye. Smelov and L. Lin: "Steps of the Experiment: 3. What Does the Collective Gain?"]

[Text] In the labor collective, as is well known, the unity of state, public



and personal interests is realized. And the conditions of the economic experiment are aimed precisely at making this unity closer and more organic.

In talking about the interest of the enterprise and its labor collective, we should, in our view, accentuate attention on two groups of questions: In the first the question is the satisfaction of the requirements of the collective for working creatively, in the second--the providing for its social, everyday and cultural needs.

All workers of the association are interested in the improvement of working conditions and the technical reequipping of production. And this is completely natural. After all, the brighter and more spacious the plants and the more perfect the equipment, technology and organization of labor, the better a person will get on with his work and the more productively and fully his abilities will be realized. But how are such favorable conditions to be created? At present this depends to a large extent on the enterprise itself and its labor collective. In the conditions of the economic experiment, there is a significant expansion in the rights of the association to use the means of the unified fund for the development of science and technology (YeFRNT) and the production development fund (FRP). For example, a part of the YeFRNT, the enterprise may, on its own initiative, use to conduct planning and design work on the creation of new equipment, as well as for the compensation of expenditures during the period of learning how to use it. This increases the creative possibilities of scientists and specialists significantly.

In the conditions of the economic experiment, the specialists of the association actively joined in the search for new ways of increasing production efficiency. A creative approach was manifested also in the formation of the plan of scientific research. As a result, the economic effect turned out to be approximately twice as high as the average for the first three years of the five-year-plan.

We will note that a vital increase in the efficiency of scientific research work is secured almost without an increase of expenditures.

What was done in practical terms? Ahead of schedule, in the third quarter, jointly with the Scientific Research, Planning and Technological Institute of Machinery Manufacture [NIIPTMash], development was completed and progressive means for the equipment of mechanical processing factories were manufactured, which have already been introduced in practice. The use of this rigging makes it possible to lower the labor-intensiveness of mechanical processing by 21,400 machine-tool norm hours per year. The total economic effect of the development--almost 50,000 rubles.

As a result of the scientific research work conducted jointly with NIIPTMash, a specialized sector for the manufacture of tooth-type couplings for enterprises of the industry was created in the association. The equipment of the sector with machine-tools with programmed control, multi-spindle semi-automatic machines, mechanized and automated lines for the machining of yokes, and the introduction of other highly-productive processes made it possible, along with the increase of the quality of the couplings, to lower the labor intensiveness of their manufacture by three-fifths. This example confirms how correctly

the direction was selected in the acceleration of scientific-technical progress, which was aimed at the expansion and intensification of inter-branch and intra-branch specialization and cooperation of production.

In the conditions of the economic experiment, it proved possible to accelerate the preparation of production for the mastery of the manufacture of tooth-like couplings with reduced metal content. The change in the design and technological process proposed by the specialists makes it possible to save more than 600 tons of rolled metal products a year and to lower the labor-intensiveness of the manufacture of couplings by 20,000 machine-tool norm-hours. This secures the improvement of the most important indicator in the conditions of the experiment--the indicator of the reduction of production cost.

During the past year, the production cost in the machine assembly production decreased by more than 1 million rubles by virtue of the realization of scientific-technical measures, including the introduction of the results of scientific research work completed earlier.

It must be said that the growth of creative activity called forth by the reorganization is also observed in other subdivisions of the association. In welding fabrication, they developed and introduced the technology of pulsed current arc welding in the manufacture of children's bicycles. The technological process of electroslag welding of waste cylinders for their use as electrodes in electroslag refining, created in this same factory, will make it possible to save several tens of thousands of rubles.

The scientific-technical subject matter is rich among the specialists of metallurgical production. The economic effect from the introduction of novelties came to 400,000 rubles here.

A weighty contribution to the development of the national economy in the first year of the experiment was made by designers of Elektrostal'tyazhmash. In cooperation with the Moscow Institute of Steel and Alloys and the Yerevan Polytechnical Institute, cold-rolling mills for tubes are being created in the design department of the Elektrostal'skiy Institute with a fundamentally new technology for the receipt of especially precise tubes with a diameter of 90-160 millimeters. The technical plan of such a mill has already been completed. Fundamentally new in it is the fact that the rolling is conducted in a stationary working stand without deformation during the reverse motion of the tube. Such a solution makes it possible to significantly reduce the inertial loads on the assemblies of the unit and thereby to increase the operating life of its assemblies and the mill as a whole. According to preliminary calculations, the effectiveness from the introduction of such equipment in the national economy will come to about 1 million rubles.

"The creation and investigation of high-speed metallurgical machines with linear electric drive"--this is what the scientific research work aimed at the increase of the productivity and the reduction of the mass of machines with reciprocating motion is called. In cooperation with the All-Union Scientific Research, Planning and Design Institute of Metallurgical Machinery [VNIIMET-Mash] and the All-Union Scientific Research and Design Institute of the State

Planning Institute for the Planning of Electrical Equipment for Heavy Industry [VNIPityazhproelektroproekt], its participants succeeded in solving the problem of significantly increasing the productivity of ring furnaces (from 300 to 500 blanks per hour). This opens up the possibility of the further growth of the scales of tube-rolling production, the increase of its profitability, and the increase of the labor productivity of metallurgists. The effectiveness of the work in the national economy amounts to 2.4 million rubles.

This list could be continued. But, perhaps, even the examples cited are sufficient to characterize the creative conditions in the engineering services of the association, without which neither the economic nor any other kind of experiment is thinkable.

The new conditions provide that expenditures for technical reequipment from the production development funds are included in state capital investments and are singled out separately in the plan as non-centralized capital investments. Moreover, means of the production development fund, which are accumulated by the association, are not subject to withdrawal. This gives the enterprise additional independence in its work to expand its production possibilities. And what is more, proceeding from considerations of economic expediency, the association now has the right, at the expense of a part of the amortization deductions, to make additional expenditures for technical reequipment of the fixed assets above the limits of the centralized capital investments. So that the collective is especially interested in the increase of the production development fund.. And it is developed in accordance with the norms: 5.7 percent of the profit received from the industrial activity of the enterprise, and 33.5 percent from the amortization for the full renovation of fixed production capital.

The acquisition of new, as well as the replacement of worn-out and obsolete equipment, the realization of measures to protect the environment, the increase in the output of consumer products, and the development of energy, warehouse and other facilities--these are the basic directions of the expenditure of the production development fund. But in order for it to be more sizable, it is necessary, first of all, to lower production cost, to reduce expenditures, to manage assiduously and, as a result, to increase profit. And here again the educational significance of the experiment shows itself. Its conditions persistently accustom people to thrift.

The additional rights granted to the association in the utilization of the production development fund make it possible, on a regular basis, to renew the machine park and to conduct long-term planning of the technical reequipment of production. Also of great significance is the possibility, which has emerged in the enterprise, to partly expand--at the expense of technical reequipment--the production areas and to build general plant auxiliary projects.

Making use of these possibilities, an annex has already been built for the bottle-less supply of carbon dioxide to Steel-Casting Shop No 2. The construction of an analogous installation is underway for the Profile Steel-Casting Shop No 1. The construction of a warehouse for models has begun, and other work projects are being planned.

In accordance with the conditions of the economic experiment, the association can now develop the contractor designs for technical reequipment through its own efforts. Moreover, the right to confirm such designs has been granted to the management of the association. This makes it possible for the enterprise to solve some practical questions far more efficiently than before.

At the same time, even in this business there are unresolved problems. Thus, the norms for the deductions into the production development fund for the financing of technical reequipment calculated for the year come to 4.2 million rubles, or 5 percent of the value of the active part of the fixed capital. In the presence of such conditions, the complete replacement of the equipment of the enterprise will take place only after 20 years, while half of the machines and aggregates have been operating 10, 20 and more years. Thus, here, too, some corrections to the in general correct conditions of the economic experiment are necessary.

According to the methodology that was in effect until 1984, the fund of social and cultural measures (FSKM) was formed in percentages of the material incentive fund. In the conditions of the economic experiment, this order has been changed. Now in the next year the fund of means aimed at the realization of social and cultural measures and housing construction is formed from the sum of such a fund according to the plan of the base year (in this case 1983) and the sum received for the above-plan growth of labor productivity. In 1984, every percent of the increase of labor productivity above the established plan increased this fund of Elektrostal'tyazhmash by 19,000 rubles.

During the past year, according to that method, the Elektrostal' machine builders received 940,000 rubles for their social and cultural and housing needs, which is 115,000 rubles more than in 1983. As a result, approximately 400,000 rubles can be spent by the collective for the construction of blocks of apartments, and the remaining part of the fund will go for the maintenance of the plant dispensary and the Voskhod Tourist Center, the acquisition of passes for holiday homes and sanatoria, for the provision of free meals for the maimed, farmers and machine operators working during the night shift, and for loans to young families.

Thus, in order to have more means for these purposes, the collective must attain the maximum possible growth of labor productivity. That is, in this case, too, the principle "The better you work, the more you receive" is operative.

However, with scientifically-based planning, you do not achieve very high overfulfillment of the plan growth of labor productivity. For this reason, the association proposes to increase the base sum and the norms for the calculation of the fund for social and cultural measures in order, first of all, for the rates of housing construction to be accelerated.

The further perfection of the conditions of the economic experiment opens up new prospects for the satisfaction of the various needs of the labor collective. And, what is the main thing, it will help them to attain the stable fulfillment of the production output plans with the least expenditures and in complete accordance with the delivery contracts.

METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

DEVELOPMENT OF MACHINING CENTERS AT IVANOV PLANT

Moscow EKONOMICHESKAYA GAZETA in Russian No 30, Jul 85 p 12

Planning for New Technology

/Three-part article under a single headline: "Integrated-Combined Method for Developing New Technology: Experience of the Ivanov Machine Tool Production Association"/

/Article by Yu. Maslovskiy, chief engineer of the association/

[Text] The scientists, engineers, workers and all the Soviet people have been given a task of particular national importance by the Central Committee of our party. It is necessary to organize the manufacture of new generations of technology, capable of increasing the labor productivity by many times and clearing the way for automation of all stages of the production process. Obviously it would not be incorrect to state that one of the prominent places in the realization of this urgent matter rightfully belongs to the machine tool industry: after all, this is the main supplier of equipment to many sectors of the economy.

Our collective produces multiple-job machines of the "machining center" type. This complex machine with numerical control is fed stock and automatically produces a ready-for-assembly part with highest precision. The machining center (MC) simultaneously replaces several machines and increases the labor productivity by 3-8 times. But this is not all. The work done by such machine uses much less metal per job, requires less factory space for the same volume of production, the training of an operator takes at most three months, and he can easily handle two machine units side by side.

Along with machine tools we also sell complete technology to customers, so that the acquired equipment can immediately put out products upon installation. Our service agency provides the purchasers of MC with the necessary accessories and tools, works out programs for them, instructs the attending personnel and carries out the installation and set-up. The working of the equipment manufactured by us and delivered to the customer is checked out over a period of years, not months, in order to promptly correct possible faults and take care of the noticed drawbacks in future designs.

The collective of the association with its powerful design bureau has introduced a fundamental innovation in the actual procedure of production of new technology. In the familiar decades-old system the designers are supposed to relay all project documentation on to the subsequent echelons, and under such procedure the first machine prototype would usually appear in no less than five years. Then a commission would examine it and make comments, and the machine would be sent back for the "final touches." Then there would come a provisional lot, and a similar procedure would occur with it. The last visas would be checked prior to release for serial manufacture, i.e. a three-stage coordination would occur. As a result of this bureaucratic red tape even the best models would often be obsolete by the time of their "circulation."

The complex-coordinated method introduced at the association, wherein the blueprints for the first parts and assemblies are instantly passed on to the technologists, designers and metallurgists, has greatly compressed the time intervals. A complete MC now comes into being in a maximum of one and a half years, or often much faster.

Of course, the reduced interval in the production of technology is inconceivable without good preparation of the industry: the prototype, casting, procurement, and also tool departments. Multiple-job machine tools are themselves made on modern NC equipment, assuring a high precision of work. The responsibilities are greatly increased for all those involved, since they are essentially working side by side, shoulder to shoulder. The inventors of the design keep track of the birth of their brainchild at all stages, even to the final testing—and delivery to the customer. A testimony to the high quality of our engineering is the fact that three-fourths of the products are labeled with the pentagon of quality, and a number of the models have been awarded certificates of the VDNKh [National Achievement Exposition] and international expositions.

Today not a single one of our products could have been released for serial manufacture more than five years ago. There is a continual renovation of the nomenclature and the latest technology is being designed at an accelerated pace, so far as our capacities allow. The production program of the 11th Five Year Period was fulfilled as of 1 June, and 100 "machining centers" will be produced in addition to the requisition.

Drawing up the project for the plan of the next five year period, we are devoting even more attention to the technical level of our machines. By the time of the 27th Congress of the CPSU it has been resolved to build the first turning and grinding "machining centers." In 1986-1990 the production of competitive multiple-job machine tools enjoying a virtually unlimited consumer demand will increase by roughly 60 percent as compared to the past five year period. A goal has also been set that all new technology be certified exclusively in the high quality category. The turnover index of the modern equipment is to be brought up to 2.8, and the working efficiency of the machines up to 92 percent.



The association will be involved ever more actively and extensively in the provision of quality metal-cutting equipment for the enterprises of flexible manufacturing systems. But our capacities are able to meet only some of these demands, to say nothing of requests for the production of other innovations. Obviously what is needed is the involvement of the entire sector and the immediate assistance of other factories of our own and "outside" ministries for the "circulation" of a product.

The coming 12th Five Year Period will be a time of fast pace, high quality and efficient operation. The success of the plans--and they are incomparably more intense, detailed and important than the previous--will depend on the self-discipline, economic initiative and zealously of all the labor collectives.

#### New Designing Procedure

Moscow EKONOMICHESKAYA GAZETA in Russian No 30, Jul 85 p 12

/By P. Bezgod'ko, chief project designer/

/Text/Before coming to the Ivanov Machine Tool Association--six years ago--I had heard about the "nonstandard" work of this collective and, frankly, I couldn't wait to get here. At that time the multiple-job machine tools or "machining centers" had already been developed here, and I was consumed with a prodigious desire to take part in the development of a fundamentally novel technology and, what is more, in a nontraditional manner.

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It is known as complex-coordinated. Briefly, it comes down to this. The documentation and blueprints for the machine being designed are forwarded by the designers like a conveyor belt, as they are ready, in stages. First off, the designs for the basic parts and assemblies most difficult to manufacture are prepared and passed from hand to hand, as it were, to the technologists, metallurgists and other specialists and sections involved. These immediately, without wasting a single day or hour, set about their work, transforming the paper drawing into metal.

In other words, the old system of a long-drawn sequence--design from start to finish, preparation of production, prototype, provisional lot and series--has been discarded. It is replaced by a mobile system, shortening the entire process of production by 3-4 times, i.e. instead of five years it takes no more than one and a half years to make a MC.

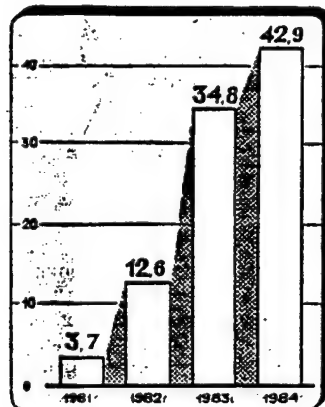
The legitimate question arises: isn't the number of errors increased with this system? On the contrary, there are fewer, since each party feels a direct and urgent personal responsibility in face of his comrades and the entire collective. For when it took several years to "get to" the blueprints the designer was liable to forget about them. Most often he would not get to see how his brainchild was transformed into a machine or a particular part. But with the concentrated method the inventor supervises the entire process, working alongside the technologists, metallurgists and workers, making certain corrections where needed and correcting mistakes. It often happens that we send in the blueprint for the last part when the machine is nearly assembled.



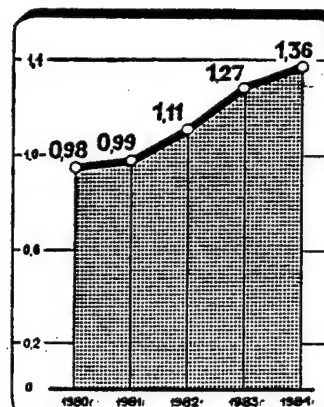
Let me point out that in our design bureau the young engineers are not kept for years working on elementary parts. Most often they are immediately entrusted with a complicated project, which in itself motivates them to work with maximum dedication, so as not to fall flat on their face but instead justify the confidence in them. Those with initiative and keen grasp are assigned to more skillful categories and advanced in rank. Let me give at least one example. In eight years Igor' Vladimirovich Goncharuk received four raises and is now a leading designer, planning the latest technology.

The professional honor and pride of each designer are concerned in creating machines which, at the very least, are the equal of their Soviet and Western analogs in performance. From the standpoint of improving the quality of the products it is quite proper that our association does not distinguish between common and export quality. Every "machining center" should be completed in the minimum time, with least cost, with no bias in terms of its quality.

RATE OF GROWTH OF LABOR  
PRODUCTIVITY (computed  
by NChP, in percent of  
the 1980 level)



GROWTH OF CAPITAL YIELD  
(rubles of merchandise  
per ruble of cost of the  
fixed production capital)



#### Quality, Cost Factors

Moscow EKONOMICHESKAYA GAZETA in Russian No 30, Jul 85 p 12

[By V. Pavlychev, head of the economic planning department:  
"Economic Analysis--Outlays and Results"]

/Text/ The most impressive flight of the engineer's imagination must be kept in check by economic analysis and computations. The material, financial and labor outlays needed to bring the thought into life should be repaid as soon as possible.

This very serious and difficult problem assumed its full magnitude when it was firmly decided to switch to the production of a fundamentally new technology.

We understood that to develop this with the old and inefficient equipment, lacking the necessary machining precision, was too risky a venture. Therefore two major problems were solved in parallel: the gradual replacement or total modernization of the existing machine tool complement and the organization and expansion of a modern multiple-job technology for our customers. Of course, this necessitated not only a maximum exertion on the part of the engineers, technicians and workers, and much organizational-educational work by the party committee and managers, but also certain capital investments and technical retooling.

We therefore scrupulously kept track of every measure involving expenses, jealously watching each kopeck. The most reliable factors in this regard are strict standardization and cost accounting. A while back this concerned mainly the workshops and production sectors, but now it is penetrating ever further into the design bureau, the departments of the technologist, metallurgist, power engineer and mechanic, and the brigades. In the accelerated pay-back of investment an extremely important part is played by the efficient employment of every type of equipment. This is achieved by shortening the time of set-up and adjustment, sharp reduction in the standstill between shifts, and high skill level of the attending personnel. All these measures over the past four years of the five year period enabled us to achieve an optimal relationship between the increase in the fixed capital and increased output of merchandise among the enterprises of the Soyuztyazhstankoprom. As proof of this I present comparative data for several machine tool associations and plants in various cities.

<u>City Where Industry Is Located</u>	<u>Increase in Production, Fixed Capital (1984 in Percentage of 1980)</u>	<u>Increase of Mer- chandise for the same period (percent)</u>
Ivanovo	16.7	63.1
Ryazan'	12.1	15.3
Gor'kiy	34.6	26.5
Kolomna	21.1	3.7
Novosibirsk	9.7	6.9
Sasovo	35.7	45.3
Kramatorsk	26.7	16.6
Average for the VPO	21.6	21.8

As we see, the growth of capital in our association is proceeding much more slowly than the increase in product output. In other words, the outlays are being repaid not in a trickle extending over many years, but in a relatively short period.

When the decision was made to set up an industry for modern multipurpose machine tools, or "machining centers", the principal tasks and the lines of

reorganization of the industry were marked out. In a brief time, all the technological and organizational solutions for rational utilization of the available space, staff and machine resources were thoroughly checked.

To create a flexible production, we rejected the idea of expanding the machine resources with manual control, or even the purchase of such machines to replace the obsolete ones. All funds were used to expand the fleet of modern NC machines. The NC machines were not dispersed among the various shops, but concentrated in a single subdivision--the technological department of program machining, which enables a very efficient utilization of them, possibility of manufacturing the most complicated products under conditions of shortage of qualified workers, sharp reduction in the production cycle and facilitation of the management function under conditions of small series and large nomenclature production. All equipment not essential to the production program is sold immediately to those organizations where it can still be used for a certain time.

At the center of attention of the planners is the parameter of material outlay per output of products. Metal and other materials, fuel and electricity are being used more sparingly, even though there are still reserves that we are trying to turn to account. However the purchase of accessory parts is very expensive, and the numbers of these are increasing, not decreasing. These sometimes cost us one and a half times more than if we produced them in our own shops. But after all, we cannot give up cooperation and become a natural economy, especially since we have no special demands on the quality of supplied parts. It turns out that an excellent new technology hurts our economic indexes. We would like to think that this problem will be solved by the headquarters of the sector, the USSR Gosplan and the Goskomtsen [State Pricing Committee].

Those who are unfamiliar with our enterprise occasionally talk as though the Ivanovo workers enjoy an elevated salary. The wages of the designers, technologists and certain other categories of our workers have indeed been notably increased in recent years. However this is not due to any special privileges, but exclusively thanks to the excellent work of the enterprise and the creative initiative and dedication of its people. Personal raises for the most qualified and conscientious engineers, quarterly and annual bonuses and material incentives for export-quality products, introduction of new technology and the winning of competitions all provide a solid overall increase in pay. Furthermore, certain groups of designers of various qualification that have been brought together for a specially quick execution of some vitally important project have been converted to piecework. But no special funds are made available for this: they are taken from the savings built up in the wage fund.

Today the association is hotly debating the project of nominal figures for the plan of the 12th Five Year Period and searching for production reserves at each worksite. The collective has set itself the goal of achieving the highest performance in acceleration of the scientific-technical progress, increase in production and efficiency of production beyond the goal set for the association by the upcoming five year period.

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CSO: 1823/212-a

METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

MODERNIZATION OF IVANOV MACHINE TOOL ASSOCIATION CHRONICLED

Moscow SOVETSKAYA ROSSIYA in Russian 17 Jul 85 pp 1-2

[Article by Y. Maslovsky, chief engineer of the Machine Tool Association imeni 50th Anniversary of the USSR: "Plant Initiative"]

[Text] It is a rare day when we do not have guests at our plant. This has always been true but we now have more visitors than ever. We tell them everything about our past and present, our mistakes and our plans and intentions. We are glad when our visitors take a keen interest in what we are doing and wish to learn from our experiences. It pains us to deal with the usual "tourists" that come "to broaden their horizons" but we must admit that they are few enough in number. We find diverse opinions among our visitors: "All of the work is done by the designers". They say, "They have tidied themselves up and have some fine fellows who are bringing about a technical revolution".

This is of course true but it is not the entire truth. Without depreciating the role of our designer's think tank, I would like to give due credit to the other subdivisions as well. The newest technology cannot be created by designers alone. The entire staff of engineers, technicians, workers and managers must take credit for the plant's great innovations. Every employee, including the director, chief engineer, party committee secretary, designer, technician, lathe operator, foundry man and fitter must take personal responsibility for the results of the plant's operations.

How did our plant come into being? We have had all of the misfortunes that machine builders usually go through and perhaps a few more. The plant is a young one, only 15 years old. Unfortunately, the equipment we received was only new in the formal sense of the word. It was technologically unable to serve as a basis for the creation of completely new equipment. However, what was chiefly responsible for pushing us into taking decisive action was a drop in demand for our production. The plant had not yet reached its rated production capacity and we already had an overstock of our all-purpose lathes. The situation became so bad that EKONOMICHESKAYA GAZETA published announcement that "the plant sells on easy terms without allotted funds...".

It seemed that the simplest thing to do in this situation was to start new production that was in demand. For this we needed a strong design base. What

principally new thing could be created by a design section that did not from the very start grow professionally and produce one model a year that was not at all the most modern type of machine tool. Of course, others tried to help us. Kindred plants in Moscow, Leningrad and Odessa gave us the designs of several of their machine tools but this did not make it any easier for us. We understood that the answer lay within ourselves and in our production...Often enough, defects and malfunctions in the work of some plant can be explained by the fact that something was not properly thought out or planned for in Moscow, the central directorate or the ministry. In my opinion, this is making oneself too dependent on others and greatly hinders the work at hand. I am convinced that any plant can quickly renew its production and increase labor productivity but we were the ones who had to prove it in action. Even now, 10 years after all that we have gone through and overcome, the step from stagnation to the leading edge of technological progress seems a old one even to us.

Everyone familiar with industry and especially with machine building knows very well how long and complicated a road it is from the idea of a lathe or a machine to its mass-production. At best, it takes anywhere from three to five years.

We began work at once in several different directions: designing the newest types of machine tools, technically re-equipping the plant, adjustment of our technology and organization of production and a new system of cooperation with clients. The essence of our complex-combined method lies in the fact that the technology for producing an item is worked out at the same time that the item is undergoing development.

Such an approach requires that the designers first prepare the technical documentation for the most complex and labor-intensive parts of the machine being designed. The manufacturers know beforehand what they must do and when certain parts and components must be made. They receive blueprints and see that production is ready on time. This has now become the law for us. We already have the experience behind us to work the new way. We can say that we discovered ourselves and were surprised at what we could do: on 3 January 1976 we began to design an NC-machine. The blueprints for its frame were sent to the pattern shop on 21 April and by 30 April, its castings were ready. The machine tool industry had never worked so fast before. Ever since then, our standard has been to design one new machining center model and start its mass production in no more than one year's time.

Sometimes, I am rightfully asked about changes and corrections. We do of course receive some criticism but it is minor and is always considered in subsequent models. Having to work without the right to make mistakes at any level of production has made it possible for us to avoid later having to make numerous changes or change designs. We are not dealing with traditional metal-cutting tools but complex, multi-operation machining centers that are superior to the best machines anywhere in the world. By compressing time and working under tight schedules we have been able to bring about mobile production. We made it mobile by reconstructing and re-equipping our plant. Let us take the pattern and casting shops as examples.

Our former casting shop was, to say the least, not too comfortable and never attracted many workers. After it was extensively reconstructed, the working conditions in this shop improved very much. Even the very tedious "earth" [zemlyanaya] operation after parts are chiseled has been replaced with completely new technology. Innovations made it possible to reduce by nearly 400 the number of workers in the shop. Just try to manage that! We have put together an excellent creative collective. Take our famous foundry, an eternal reproach to machine-tool shops. For their transformation of the casting shop, Chief Metallurgist Rumyantsev and New Equipment Bureau Director B. Stepanov were awarded the USSR Council of Ministers Award. Recently, among the especially distinguished workers of the plant, the director of the casting shop, L. Tsymbarevich, was awarded the Red Banner of Labor Award. The shop owes many of its technical innovations to his efforts. I cannot remember a time when Lev Ignatevich put off doing any job or took out his frustrations on others. Along with Comrade Tsymbarevich, other directors have worked very seriously to improve working conditions.

At this time, a progressive trend in world machine building is the welding of parts from steel sections. However, we still lack the high-efficiency welding equipment that we need for this process. For that reason, pig iron casting is the process most used. A bottleneck in the casting process is the pattern section. When we readjusted production, we wondered whether a single pattern section would be enough for the quick production of cast parts. We have found that we need at least two pattern shops. Who will build them and how? Where do we find the specialists and patternmakers? We laughed at this utopian dream and got to work to reconstruct the existing pattern shop. This freed extra work-space and increased output. Most of all, we improved our engineering and technical preparation which made it possible not only for extra-class patternmakers but also for specialists of average qualifications to fulfill tasks that are not at all simple. The blueprints are still not finished but the patternmakers are already at work with the designers: what are the parts being prepared for, what dimensions will they have? You might say that it is just a fantasy to produce a model in 4-7 days without using any blueprints. Our entire pattern shop which was at that time directed by Chief Engineer N. Toporov was set for one operation. And it is still continuing to work creatively at full capacity.

Our plant now has about 150 NC machines and machining centers. It must be said that all of our main machine tool models remain with us. We have therefore armed ourselves with the latest word in equipment and we test our offspring at work and then make the necessary changes and corrections. Programmable machines are not the dominant part of our equipment stock but they are responsible for three-fourths of our production. This is where you can judge the enormous capabilities of modern equipment under maximum loads. And the important thing here is the time factor.

As in the production of high-speed equipment, an unambiguous approach should be taken to programmable machine tools. Mass production required new methods of organization, assembly and fitting. A complex brigade made up of designers, technicians and fitters works using a special component assembly and testing technology that simulates operation. Therefore, the cycle of testing on the main assembly stand is reduced. This saves time again but not



at any cost in quality. It is far easier to find and eliminate faults in a separate unit or assembly than in a finished machine stuffed full of electronic devices.

The new technology has dictated the need for completely new work with consumers. We maintain direct contact with our buyers. Knowing the needs of our buyers, we create machine tools with the right capabilities. We do not sell a "bare" machine but programs, a production technology and full instrumentation. Our product is therefore a complex one. Even after the machine tool leaves the plant, it still remains "ours". We train cadres to work on it, help consumers more quickly master their use and provide a service guarantee. In other words, we have established our own plant division responsible for service.

The introduction of any advanced item makes obvious old, obsolete methods. However, it is only a complete set of all elements and measures that provides mobile industry capable of quickly converting to new production, mobile regulation, a level of product quality equal to any on the world market and the tight schedules for mastery of new machinery. Who is it that can do all of these things?...People such as foreman A. Pryakhin, a Hero of Socialist Labor and city soviet deputy. His complex brigade of machine operators is given the most complicated and responsible tasks. Or young production directors such as the foreman of the assembly section of the largest machine tool, A. Gusev, and the tool shop foreman, A. Ushakov. They finished school to work in industry to work directly with people and found themselves very useful there.

Even during the hardest times when the plant was one of the ones that was always behind but was working out its new technology, there was no question here about the prestige of the work of an engineer, designer or machine operator. They came to us and stayed because of their interest in the work and the possibilities to think, create, make suggestions and do things. We have a very good group of innovators. It is not immediately clear how this came about. Young and capable people came to us but we did not lure them or make promises. We quite frankly told them that across the street there was a plant with higher pay and less hectic work. We told them to think about it because we offered only the most modest salaries without any premiums or bonuses and that things would stay this way as long as we were behind in our plan and using old machinery. But we did tell them that we have very interesting "extra work" needed by the state and requiring our full dedication, strength and time. Some went away. Our cause did not turn out to be for everyone and some were more interested in their own welfare and peace of mind. Some of them envy us even now. They could have been very useful to us and discovered their own creative abilities. Those that stayed and made our factory and the Soviet machine-tool industry famous are such happy people! I have seen this among my friends and colleagues and am glad for them.

One of them is Evgeny Borisovich Chudenko, director of the drive laboratory who is the sort of person who, as they say, thrives on work and feels responsible for everything around him. I have never seen him vain of anything or raising his voice at anyone. And we so often find ourselves in the most varied and conflicting situations everyday! The production of his subdivision

is not paper-pushing but machines embodied in metal. Igor Alekseyevich Fedoseyenko heads the section designing devices for the NC system, in other words, he "gives machines their hearts and minds".

Stanislav Evgenyevich Gurychev started out as the leading designer of new machines. Today he is the chief engineer of one of our ministry's best special design bureaus, a specialist of the highest class and an authority acknowledged not only in our country but abroad as well. Two years ago, eight of our young designers were awarded the Lenin Komsomol Award and the pride and the recognition of the entire collective that formed itself not from just highly-qualified specialists but people with a civil understanding of public and personal responsibility.

Many of our chief designers have not reached the age of thirty. What is it that keeps them in Ivanov where it is not easier but harder than in most places to find a place to live and where the work often demands self-sacrifice? What brings to us specialists from the warmer South or from larger and more comfortable cities, to change their Moscow residential registration for Ivanov? Just the work! It is only the possibility to prove oneself as a person and to be at the leading edge of the century. The spirit of the innovator gives birth to pride and the spirit of the innovator makes us work to develop completely new machinery and laser technology. At a recent meeting of the CPSU Central Committee, this feeling was described by the general director of our machine-tool association, Hero of Socialist Labor Vladimir Pavlovich Kabaidze. Our collective has the boldness to search for solutions to the unfamiliar and for experience and understanding of all of the problems of importance to the state.

12261

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## METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

### PROBLEMS OF COOPERATIVE PRODUCTION

Moscow MATERIALNO-TEKHNICHESKOYE SNABZHENIYE in Russian No 9, Sep 84 pp 36-39

[Article by G. Arzhakov, deputy general director, the Novosibirsk Heavy-Duty Hydraulic Press Machinery Production Association: "The Resource-Saving Potential of New Technology"]

[Text] Whether he is an engineer, technician or worker, a factory employee is always obliged to work conscientiously and there must be no defects or deviations from the given blueprints or technology. This requirement is doubly valid in relation to machine tool builders that work to supply nearly all branches of Soviet industry.

We produce equipment that plays an exclusively important role in increasing productivity at factories of all different types of industry. The technical characteristics and operating specifications of equipment determines the quality of the production of parts, units, machines and apparatus, the production costs and the return on the buyer's investment. In other words, having spent considerable sums, the buyer expects excellent failure-free machines and a fast return on his investment. The workers of the Novosibirsk association know this quite well and are guided above all in their work by the interests of the buyer.

Our production association is unique. We specialize in the manufacture of heavy-duty horizontal milling and boring NC metal-cutting machines and longitudinal lathes. We also make different types of hydraulic machinery such as powerful presses for packing scrap metal and scissors-presses for cutting large metal chunks, hydraulic profile presses for applying aluminum rather than lead jackets to cables and many other types of equipment. The pace of production in our plants increases every year.

The association's products are well known both at home and abroad. Many items have received the state seal of quality. The heavy-duty metal-cutting machines and large forge-presses produced in the 10th five-year period made it possible for the national economy to save 12 million rubles per year.

We recently began to produce a new horizontal borer with greater technological capabilities. It has numerical control and increased strength, precision and output. The metal content of this new model is 28 percent lower than previous

designs. The borer is equipped with special attachments and accessories that greatly increase the number of ways that it can be used.

The great selection of combined longitudinal lathes has many purposes. Any one of them can be used to plane, mill, drill or bore many different parts. One of these aggregates was recently installed at the Atomash Plant in Volgograd. It will be used for multi-operation machining of large parts. Its use will save the power equipment manufacturers 120,000 rubles per year because of the sharp reduction in the number and concentration of auxiliary operations. The machine has provided a 150-percent increase in productivity while the consumption of metal and power have been reduced 25 percent.

Economic experts have highly rated our machines. Without any excessive modesty I would like to mention that we often enjoy such praise. Here is just one example. The association of the Moscow Machine Tool Factory imeni Sergo Ordzhonikidze has informed us that its combined milling and planing NC machine has helped to considerably simplify its production technology. This machine has allowed them to concentrate the machining of parts in one shop. At one time, some of the work done there now had to be sent to another city.

Last year the association began to mass produce a 630-ton press for packing scrap metal. Our press has many advantages over a similar one made by Harris (USA). The press is designed to weigh scrap metal before loading, it rests on a welded base, works in semiautomatic mode and requires only one operator. Finally, its output is 20-30 percent higher than the famous Harris press.

The association has been able to successfully realize a plan for technical re-equipment aimed at increasing the quality and reliability of its products. Labor productivity is continually increasing. The basis for perfection of production is the introduction of advanced technology in metallurgical and metal fitting operations as well as the reconstruction of production. However, achievements in the designing and improvement of technology do not solve all of the problems and tasks that we are stubbornly working on.

The manufacture of very precise machines that can quickly perform most of the more complicated operations and do not require a lot of operating personnel would be inconceivable without excellent specialists and above all designers and technicians of the highest qualifications. We are doing more work in this area and it seems to be going well or in any case, no worse and perhaps somewhat better than in the other plants of our region.

The office of the chief machine designer and the press design bureau as well as those of the chief technologist and metallurgist form a collective of highly-qualified specialists able to resolve the most complicated tasks. To enrich their own knowledge, our leading technologists visit other Soviet plants. They have established lasting working contacts with their colleagues in other industrial scientific research institutes.

The people who set the standards for our products deserve the warmest words. However, the leading technological institutes only give rough specifications required for the equipment we produce: they set approximate machine dimensions, work speeds, etc. The rest is worked out by our designers and

technologists for whom one draft of a project is obviously not sufficient. As designers, they should be possessed by their work, with a heightened feeling for innovation, quick analytical minds, and professional self-esteem. The drive to be better than others is for this category of engineers especially meaningful and valuable.

However, to this time, we cannot say that the selection, placement and education of creative technological intellectuals is proceeding as well as it could. Furthermore, the problem of creating sufficiently powerful technological design services with highly-qualified specialists is in itself not a simple matter which has in recent years become even more complicated.

In view of the high professional requirements placed on specialists, there have been found some shortcomings associated with a lack of material incentives. The work of leading machine designers and the staff of the offices of the chief technologist and metallurgist is paid much less than that of skilled workers. Without underestimating their contribution to the creation of unique equipment, we must properly assess the role of technical creativity, the ability to skillfully embody the most advanced achievements of science and technology in the design of machines and presses.

This has now become especially important since we have already begun to see alarming symptoms such as a smaller number of highly-qualified specialists. Young scientists and designers are not working in creative laboratories but are going over to industry where there is work and where other skills are needed and the salaries are higher.

More and more of the leading specialists in technical services are older persons. With time, this tendency can lead to consequences that will be difficult to overcome. It would therefore be justifiable for individual technical collectives working to resolve the most important tasks in the building of machines and presses to be given the status they need to work creatively and receive their deserved moral and material compensations. It is felt that the USSR State Labor Committee must take a very serious look at this problem.

The association is paying great attention to the rational use of raw materials, fuels and other resources. This is very important for us because these resources make up more than 50 percent of the costs of production. The association's collective is taking part in an All-Union social review of the effectiveness of using raw material, unfinished materials, fuels and other resources and has had some fairly good success. Last year, the participants submitted 290 proposals, the introduction of which could save over 100 tons of rolled metal and a larger amount of lumber. The plant is constantly reducing its losses from defective products and is carrying out plans to reduce any waste of iron and nonferrous metals, scrap metal and heat-resistant items.

The metallurgical industry has successfully fulfilled its tasks to economize the casting of pig iron, steel and light metals. All-purpose combined core boxes have been introduced. These not only reduce the consumption of scarce wood materials but to even more operatively solve problems of a technological nature.

However, in this important cause, we still have some serious shortcomings. The task of saving rolled metal has not been completely fulfilled, mainly because of disruption of the production plan. Fuel overconsumption has been allowed in metallurgical operations. Work to convert ovens to natural gas has been delayed. These omissions have now come under the control of the association's administration.

Large-scale and timely supply of equipment and materials is of great importance to the efficiency of all subdivisions. Journals are featuring pages of discussion on the problems connected with the work of plants taking part in industrial cooperation. I wish to continue this theme.

Everyone knows that the larger and more complicated an industry is, it becomes "tied" to a large number of related industries. Let us say that we machine builders have certain partners that supply us with electrical drives, others give us our hydraulic systems while a third partner has to provide us with the electronic "stuffings". All of these are a set of parts used in our products. This is very well if they are produced at the same time that they are needed by our assembly shops, that is, if the production does not disrupt the rhythm of work. And what if there are delays? We must then strive to put our machines together more quickly.

A large role in the organization of cooperative work between plants is taken by the industrial ministries and the organs of the state system for supply of materials and equipment. Some improvements here have been noticed lately. The bureau of material and equipment supply and the West Siberian Territorial Administration have begun to give us material resources to fully meet the state plan.

A conference between party committees of the Western Siberian Chief Territorial Administration, associations and a wide circle of representatives, party and union activists, industrial leaders jointly established measures to increase the efficiency of industry and the fulfillment of tasks to economize and save materials has played a great role. In particular, the supply of many of the most important materials and parts has improved and organizational problems are being better handled.

However, it is still too early to say that all problems have disappeared. It seems that the territorial supply organ could do much more for us and do it better than they have so far. Let us say that the Kuznetsovo Metallurgical Works imeni V.I. Lenin supplies us with cast iron and pig iron. We share direct and extensive economic ties. Even though the supply of cast iron improved last year, the supply of pig iron has remained too low. This confuses not only the work of metallurgical shops but of the entire association as well. On the one hand, the metallurgical works has of course fully met our needs but on the other hand it has also not at all compensated us for the losses that we have borne from late or incomplete delivery of materials. This brings us to the conclusion that direct long-term economic ties are still not the best guarantee and symbol of reliable material and technical support and this gives the territorial and central supply organs much elbow-room for creative thought.



Our association manufactures 630-ton packing presses for ferrous metallurgy factories. They have performed very well and are very necessary to the large metallurgical works and plants of Vtorchermet [not further identified].

The manufacture of Bokovin machine bases requires thick sheets of a certain grade of steel. It is rolled by the Zhdanov Metallurgical Works imeni Ilich and the Azov Steel Metallurgical Works imeni Ordzhonikidze. However, the delivery of this steel has become for us a constant and painful problem. The Zhdanov Works has fallen short by about 100 tons of sheet steel that could have been used to make 1-2 unique presses. Alas! Our intentions could not come to any material form. Azov Steel fell short by 120 tons and that is two presses.

Since this conversation concerns supplies, we must point out still one more painful problem: material and technical support for the production of new technology and the search for new engineering designs.

Let us look at a typical variant -- the association was assigned the extremely difficult task of creating an entirely new design for NC machines not within three years but in 18 months. We immediately put together a tight schedule and properly prepared all subdivisions to carry out this task. Our partners, however, did not offer any concrete proposals but sent us stereotyped responses about how they were already overloaded and how they could not take any additional orders.

Formally, they were right. The existing regulations on the supply of industrial and technical products set very clear deadlines. For example, for 1985, it is necessary to submit an order no later than 1 March 1985. However, it is very hard to plan far enough ahead for innovations. An idea can occur at any moment and if it is to be brought to life "out of order", everyone who is supposed to implement this new idea must be in a position to do so if necessary.

Consequently, some reserve channels are necessary to give innovations a green light so that they can be quickly realized. I cannot offer any concrete examples of how this is to be done but the practice of association has more than once had to deal with difficulties in the development and production of new equipment. This is not meant to be a criticism of any particular supplier.

The machine tool industry's tasks to accelerate scientific and technological progress require that ministries, institutions and especially the state system for material and technical supply to more efficiently guide and supply the creation of new equipment. This will only be possible if industrial collectives are able to quickly execute new technical designs.

To conclude with the association's plans, our collective is successfully carrying out its basic assignments. We intend to reduce our outstanding stocks of materials and to hasten the turnover of transactions. We must improve planning and perfect our methods of bookkeeping. We must also improve the level of production supervision and more efficiently use our computer

center. We are concentrating special attention on fulfilling our quota plan and production agreements. The present year will be decisive. We have already had some success in fulfilling our plan for the 11th five-year plan but it could have been greater and this is what the efforts of our collective are aimed at.

12261

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## METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

### MODERN NC MACHINES SOLVE QUANTITY, QUALITY PROBLEMS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 31 Oct 84 p 2

[Article by V. Korneyev, general director of the Kuybyshev Machine Tool Production Association: "The Level and efficiency of New Technology: The Results of Reconstruction"]

[Text] For a long time, there have been complaints about the low quality of our products. We were told: "You manufacture a coordinate-borer of the highest class. How can you allow them to go to the customer with defects?"

There are many well-known things that go into product quality. These include irreproachable technological discipline, high worker professionalism, good materials, reliable components, etc. We have always been "pulled" by these same strings but could not achieve the needed result.

We then decided to take a different approach on the problem of quality, to determine what was preventing us from manufacturing good products. And we succeeded in finding that poor quality is more than anything a result of poor work rhythm in which as much as 80 percent of the monthly quota is made up in the last 10 days of that month. Everyone has the same concern during such "stormy" days and nights: to fulfill the program as fast as possible. No one has time to think of anything else.

What were the causes of this poor work rhythm? We found that two subdivisions have held up the entire plant. These were the casting shop and machine shop no. 6. In the machine shop there were 30 universal lathes but they did not have enough lathe operators for the first shift alone, not to mention the second. If even one worker failed to show up the consequences were very serious. With the equipment that it had, the casting shop simply could not work at full capacity.

The solution was quite obvious: we had to renovate our production and introduce the most modern equipment and introduce advanced technology. We judged that new equipment would have a double effect. It would increase productivity and this meant that it could save us from having to increase our production area and take on more workers. It would also improve the quality of metal working and casting.

We began to work at once to carry out the necessary measures. In the machine shop, we replaced the universal lathes with NC lathes and then introduced a robotic complex. Looking over the list of parts manufactured, we grouped them so that they could be made using standard technology. We also organized a special service to adjust and repair new equipment.

This shop now no longer has lathe operators but NC lathe operators and tool setters. We now need far fewer workers because from the very start an operator could service two and now up to four machines. The shop works two shifts and the product quality has stabilized.

The casting operations have also been changed. Lines were introduced to make molding sand and molds. They operate semiautomatically. The drying stage has been dropped from this process because molding of parts is done using cold-setting pitches. This provides a high percent of good castings.

Four of the latest of our own machines have been installed in a shop for machine tooling of large cast parts. Two of these machines are machining aggregates with automatic tool and blank changing systems.

We did not forget blank production. This is the very beginning of the technological process and it is here that the quality of the finished product is determined. We now have a semiautomatic line that works efficiently with metal-cutting robots. This section requires only two operators.

What have been the results of all of this work? Here is only one example: now more than half of the association's products have received the state seal of quality while a mere 5 years ago, none of them had it. As we already know, quality is an all-encompassing indicator. However, even with the most advanced technology, there is not much that can be achieved if technological and manufacturing discipline is not observed and care is not taken to improve the professional qualifications of the worker cadres. The new technology has in itself made it possible to start working to improve all of these different aspects of product quality.

The plant's technical re-equipment is continuing. As early as next year, shop no. 6 will become a flexible automated technological complex. A computer will plan its work and control the automatic storage of blanks and finished parts. A new transport system will feed plans, tool sets and blanks directly into the machine.

Within two years, the plant will become the type of automated technological complex that is able to quickly readjust itself to new production. Nine machining aggregates will perform drilling, milling and grinding operations.

The new technological base is allowing us to work more boldly to implement complicated tasks. Next year, the greater part of our production will be renovated. A planned drilling, milling and boring NC machine of a level of automation and precision never before seen by Soviet machinery will go into production. This machine is designed to machine any curved surfaces and simultaneously work two coordinates. The operator will communicate in dialogue mode with a minicomputer. The machine will dictate to the operator

the sequence of operations and the operator can in turn "edit" the given program if necessary. The machine's magazine can hold 40 tools. The computer controls tool changing.

About two-tenths of these machines have already been produced and the response to them has been very good.

Another novelty is the drilling, milling and boring coordinate machine with horizontal spindle arrangement (machining aggregate) and automatic tool and blank changing and high speed.

Both machines were created by our own designers. Moreover, we must point out that the association has also considered the automation of engineering work and we are already using a computer-aided design system. It not only makes design work easier but increases output and makes it almost impossible for errors to be put into blueprints. In the not-too-distant future we will be installing the first automated designer's work place including a computer, displays and graphic plotting attachments.

Finally, a little engineering work is required to introduce new equipment to a plant and V. Fillipov, N. Olkhovsky, S. Savelev, Y. Rybalko and others worked with great enthusiasm for this cause.

We would like to point out that we do not regret the money spent on the introduction of technical and technological novelties. We spend about two million rubles a year on new technology and this investment pays itself off hundredfold. New equipment has been found to have a direct influence not only on the quality of production but has also considerably improved almost all of the technical and economic indicators of the association. The state plan is being stubbornly fulfilled and profits are higher than planned. Since the beginning of the year, there has been a more than 10 percent growth in the realization of production, labor productivity has been increased and production is more rhythmic. Furthermore, our contract agreements have been 99.8 percent fulfilled. All of this confirms the commitment of the association's collective to its modernization.

12261

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METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

KIEVTORGMAH RECEIVES NC MACHINE TOOLS, ROBOTS

Moscow MASHINOSTROITEL in Russian No 6, Jun 85 pp 7-8

[Article by G. I. Vyskrivchenko, S. S. Zharskiy: "As the Collective Ordered"]

[Text] The main purpose of socialist competition of workers of the "Kievtorgmash" production association is improvement in production efficiency and quality of work. Massive efforts mounted to this end have been rather successful. In three years and eight months of the 11th Five-Year Plan customers received additional production in the amount of 2.5 million rubles, with 2 million rubles realized above the plan, including 513,000 rubles' worth of consumer goods. The increase in production was obtained on the basis of greater labor productivity, without increasing the number of workers. In January through August of 1984 the rate of growth in labor productivity measured 107.8 percent versus the plan figure of 104.4 percent, while production cost was reduced by 2.2 percent. Measures taken to improve the technical level and quality of products have also proved beneficial in that 73.2 percent of the products are being made under the State Mark of Quality.

The association group is an acknowledged leader in socialist competition. For 1981 and 1983 it was awarded the Transient Red Banner of the CPSU Central Committee, USSR Council of Ministers, All-Union Central Trade-Union Council and the Central Committee of the All-Union Lenin Young Communist League; for 12 quarters of the current five-year plan it was judged to be the best in the branch; it was distinguished by the Transient Red Banner of Minlegpishchemash and the Central Committee of the Machine and Instrument Construction Workers' Trade Union.

In the 11th Five-Year Plan Torgmash personnel are presented a task of increasing by a factor of 1.3 the volume of net normative production without hiring additional workers. To accomplish this task it is necessary to renew the active part of fixed capital on the basis of new machinery. Emphasis should be placed on full mechanization and automation, employing industrial robots, manipulators and program-controlled machine tools.

The association's general developmental program of scientific and technical progress provides for advanced development of technological realignments to effect high growth rates of labor productivity. Resolution of these tasks involves the systems approach to the utilization of the potential of research and technological design organizations and the introduction and maximum use of



the most modern equipment. As a result, since the start of the five-year plan "Kievtorgmash" has benefited from the introduction into the technological cycle of 34 numerically-controlled machine tools, eight robots and manipulators; six mechanized warehouses have been equipped.

Mastering the new machinery and technology and not receiving all the benefits means taking only partial advantage. For this reason, after studying carefully and applying creatively the experience of the Dnepropetrovsk Combine Plant imeni K. Ye. Voroshilov and of other machine construction enterprises, Torgmash personnel developed a competition with the slogan "A Full Workload for High-Output Equipment." Originating in the communist labor shops, this initiative was propagated widely in all association subdivisions. As a result, the output of the numerically-controlled machine tool section in the machine shop rose by a factor of 1.5 in the first half of 1984. The workload of the newest stamping equipment has increased. The end of the five-year plan will see maximum loading of numerically-controlled machine tools and manufacturing operations involving robots, which will replace universal metal-cutting equipment.

Of special interest to association specialists was the experience gained in evaluation and elimination of work places of the Dnepropetrovsk Combine Plant, which is being introduced into practice to an increasing extent. The initiator of this measure was the electric welding brigade of A. N. Davydov. In off-shift time brigade members re-equipped the work places, the group approached the problem of work place evaluation head-on, achieving complete interchangeability and reducing labor expenditures by 4.5 percent in the process. The experience gained by the electric welders is being actively implemented in all brigades of the association. In general, as a result of the technical re-equipping and rearrangement of work places, the number of the latter was reduced by 69, with 31 more to be eliminated by the end of the five-year plan.

This work requires constant attention and a systems approach. The administration, party and trade union committees of the association have established a special office for coordinating the activity of subdivisions and services relative to effecting a balance between amount of work places and number of personnel involved. Cost-accountable brigades with pay based on final result and quality rating have been organized in high-output equipment sections. To assure stable functioning of these groups, moral and economic incentives have been refined and cultural, general, sanitary and comfort conditions of work improved. Enterprise resources are being used effectively for these purposes.

An integrated system of production control, labor quality and product quality has been established in the association. One of the system's most important components is a subsystem for production capacity monitoring. Its task and purpose is to serve as an interface for the subdivision supervisor relative to the need for systematic attempts to effect optimum loading of each machine tool and each square meter of production area. In association shops and sections displays have been set up to provide graphic information on functioning and performance of the subsystem. Results attained by groups within the subsystem framework are unfailingly taken into account in competition tabulations.

The association is cooperating actively with 25 institutes of the country and developing jointly with them 35 practical science subjects. Non-traditional ties between science and the production sector are also being maintained. Thus, in the chief technologist's department there is a group involved with development and application of a system for designing layout charts for sheet metal to be used for manufacturing rectangular pieces by means of mini-computer. Included in the group are plant personnel and staff members of the Computing Center of the Kiev State University imeni T. G. Shevchenko. Specialists of the Institute of Electric Welding imeni Paton have collaborated in introducing into production practice equipment for capacitive percussion welding of studs.

Scientists are helping plant personnel prepare for the design of flexible technological modules, manufacturing complexes which can be readjusted quickly and robot systems. By the end of the five-year plan the economic effect of collaboration with institutes will exceed one million rubles.

The new machinery and technology will bring the expected results only if the proper conditions of work and employee privileges are provided. Social development of the group is a constant concern of association, party and trade union committees; it is the subject of their many conferences, party and workers' meetings. In all shops comfort areas and Lenin rooms have been set up and equipped; capacity of dining halls enlarged; automatic food dispensing machine areas renovated. In most shops rest areas have been set up, pioneer camps and rest bases improved substantially; hothouse economy developed; a grocery store outfitted, and a fruit and vegetable stand built to sell produce from the associates sovkhov.

The creation of a sound social environment has made it possible to reduce personnel turnover to almost one-third of the past amount. In 1980 the rate was 13.3 percent, while in the first half of 1984 it dropped to 4.8 percent. Group stability is also being attained by means of other ways of handling people. Of importance in the development of creative, labor and social activities of workers are party-sponsored training, komsomol political education and economic sessions, in which over 1,400 production workers are involved.

Of special concern are people who will replace the present working personnel. The very basis of training for young workers is the inter-school combine, which has become an organic part of the machine shop. In addition to acquiring skills in operating lathes and milling machines, the pupils become actively involved in the working rhythm of the shop by manufacturing actual production items themselves.

The production and technical potential of "Kievtorgmash" is growing steadily. The creative atmosphere and determination to discover and realize production growth potentials are characteristic group features of the advanced association, which by its enthusiasm has won a high reputation as leaders.

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13005

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AUTOMATED LINES AND AGGREGATED MACHINING SYSTEMS

AUTOMATED, ROBOTIZED PRODUCTION DOUBLES PLANT CAPACITY

Kishinev SOVETSKAYA MOLDAVIA in Russian 3 Jul 85 p 3

[Article by O. Grabovskiy, ATEM correspondent: "A Computer Finds Defects"]

[Text] An automated system introduced here will help trouble-shooters eliminate defects in the most complicated geophysical systems being produced by the Vibropribor Association. Following a prescribed program to check the reliability of equipment being produced, it discovers defects and shows their location on display screens. On account of this, search time for defects and quality control of manufactured articles is reduced to one-fifth of that otherwise required. Electronics have made these operations more attractive and practicable.

"According to the general program of technical modernization being carried out at the enterprise," says the chief engineer of the association, G. Kuzmichev. "More than 100 robots, manipulators and program-controlled machine tools have been put into service since the beginning of the five year plan. Wide use is being made of hot stamping, pressure casting of metal and plastics, manufacturing parts from metal ceramics and other modern technology. This has made it possible to double labor productivity. General culture of production have been raised. Hundreds of workers have been nominally freed from labor intensive operations. Without expanding production areas of the number of personnel, the enterprise has doubled output of products which are in large demand. These are now being exported to 30 countries. This testifies to the high quality and modern technical level of these instruments, more than 60 percent of which hold the Pentagon of Merit [seal of quality]. The light-sensitive oscillographs, multichannel magnetographs, analog computer systems and geophysical apparatus are widely used in many branches of the economy."

General Secretary of the CPSU Central Committee M. S. Gorbachev noted at a CPSU Central Committee conference on questions of scientific and technical progress that instrument building, microelectronics and computer technology are the catalysts of the technical revolution. They need to be developed more rapidly. In this connection, present technology and equipment at Vibropribor will be completely updated during the forthcoming five year period. A territorial production center for robotization and automation has already been formed here. This permits more effective use of the experience of the leading collective at other related enterprises in the republic.

## AUTOMATION LINES AND AGGREGATED MACHINING SYSTEMS

### BRIEFS

NEW AUTOMATED PRODUCTION SHOP--Leningrad--A flexible automated production section has been established within the Kirovskiy Zavod Production Association utilizing Soviet-made metal-cutting machine tools and computer technology. The section operates within a machine shop which manufactures assemblies and parts for the Kirovets tractor and makes possible a substantial increase in labor productivity. The manufacturing cycle for parts is shortened and a large number of workers are freed for transfer to other shops. The collective of the new section is composed of young specialists--graduates of higher educational institutions and leading workers. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 25, Jun 85 p 16] 13032

BULGARIAN MACHINE TOOL INNOVATION--An automated equipment module, created by Bulgarian machine builders and designed for machining parts with complicated geometrical shapes, meets the latest machine-building demands. A built-in instrument panel and an automated system for changing and checking tools permits different versions and various procedures of carrying out turning, milling, drilling, threading and other operations. A manipulator, installed on a transport cart, delivers semifinished parts to the machine tool and removes finished articles to the storage area. [Text] [Moscow KRASNAYA ZVEZDA in Russian 30 Jun 85 p 3] 13032

AUTOMATION IN BEARING PRODUCTION--A program of automating production is being carried out successfully at the Saratov State Bearing Plant No 3. A group of plant specialists under the supervision of Aleksandr Gavrilovich Blaznov, chief engineer of the Department of Automated Rotor Lines, has created and introduced into production 16 multi-purpose automated rotor lines. Their use has made it possible to double production output without expansion of production area and increasing number of workers. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 27, Jul 85 p 17] 13032

INSTITUTE DEVELOPING PRODUCTION MODULES--Moscow--Specialists of the Experimental Scientific Research Institute of Metal-Cutting Machine Tools (ENIMS) are successfully working on creating flexible production modules. Photo caption [not reproduced]: Set up of AUTOMATED SEGMENT based on the serially produced IR-800 Machining Center. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 31, Jul 85 p 2] 13032

CSO: 1823/224

## ROBOTICS

### NEW APPLICATIONS OF INDUSTRIAL ROBOTS NOTED

Moscow IZVESTIYA in Russian 3 Jun 85 p 2

[Article by L. Volchkevich, chairman of the VSNTD Committee on Automation and Mechanization of Industrial Processes: "Robots Today and Tomorrow" under the rubric "The Critical Question--Introduction"]

[Text] Until recently industrial robots around the world were developed mainly for automation of loading and transport operations. Not that this was a question of greatest necessity. It was easier to solve the problem of replacing manual by automatic manipulation.

However in recent years new trends in robotics have appeared. The first of these is the switch from loading/transport to industrial robots. These do not merely imitate human actions, but enable both a faster and better performance of industrial operations. The assortment of such operations is rather large: spot and seam welding, cutting, soldering, cleaning of surfaces, removal of burr, painting, application of galvanic coatings and so on.

The foremost achievement here is the improved quality of production through more precise adherence to operating conditions than is possible with manual labor. Productivity is also boosted through greater speed, load capacity and multiplicity of hands. The majority of these processes are heavy and deleterious to the health. The introduction of such robots enables a total removal of humans from harmful environments.

The second trend is the switch from hydraulic drive to electromechanical and the development of designs with a great variety of movements. This opens up ways of improving the speed and precision of motion of the robot "hands" and greatly enlarges their areas of application.

Yet another innovation is the proliferation of suspension-type robots designed for areas attended by many machines, even for welding, painting and other operations. Their installation does not require additional space and they are easy to service.

There is every reason to consider these new trends long-lasting and progressive. It is remarkable that, at the "Robot Complex-85" exposition,

not one of the leading foreign companies displayed loading-type industrial robots!

In the USSR the most serious attention is devoted to robotization. In 1985 it is scheduled to produce around 15,000 robots--nearly 3 times more than in the entire preceding five-year period.

Our committee has analyzed data from 52 machine and instrument building enterprises where more than 900 industrial robots have been introduced in recent years. Of these, as we discovered, technological robots for welding, painting, galvanic coating and so on comprise merely 9 percent, while loading/transport robots amounted to 72 percent! Only half the robots are used within automated complexes, the others have been introduced singly at scattered locations.

Analysis of these statistics reveals that we pay extremely little attention to such critical sources of robot effectiveness as the enhancement of quality of production and labor productivity. The introduction of robots at those presses and machine tools where only a single billet is worked at one time often results in lower productivity as compared to manual operation. The only remaining source of economy is the wages of the replaced workers, although even these are too often "conditional." According to the data of the enterprises themselves, 91 percent of the introduced robots have replaced only a single person per shift, or even less. This means that the maximum savings in wages by the introduction of a single loading robot do not exceed 4000 rubles per year. At the same time, the cost of robotization of a single machine tool is roughly 40,000-50,000 rubles, not counting the annual operating expenses. In sum, the expenses greatly exceed the savings.

It is easy to conclude that the introduction of loading/transport robots to service only a single equipment unit with the sole aim of "replacing a worker" is economically unprofitable. Nor are the social problems dealt with in the appropriate way. For the industrial robot is the most important means of liberating man from heavy and unhealthful work. But we are introducing it primarily at operations that are neither unhealthful nor heavy!

The greater capabilities of industrial robots are generally known, but only a limited number of institutes in the USSR are involved in their development. At the same time, hundreds of collectives are creating and adopting every conceivable design of robot for the loading of metal cutting machines. Why? The answer is simple. In circumstances when any robot design is regarded as an achievement, while the chief criterion of judgment is the paperwork per job, such a procedure is easier and more convenient.

The concentration of resources and manpower on low-efficiency robot sectors (loading/transport robots instead of industrial ones, floor models instead of suspension robots) could not fail to result in serious difficulties with the introduction. Manufacturing with its merciless laws has rejected and will continue to reject the excessively expensive, slow-running and



undependable designs. But usually it is the industrial workers themselves who are most often revealed as the culprits, being accused of conservatism and "unwillingness to accept robots as partners." And the disciplinary measure has been a system of planned requisitions for introduction of robots, imposed on the enterprises from above, as a rule with no relation to the actual possibilities and needs, but with strict penalties for noncompliance.

In the beginning such a method may even have been advantageous, in stimulating the attention of the enterprise managers to the question of robotization. But today it only gives rise to a tendency toward superficial well-being.

At the April Plenum of the CC CPSU it was asserted that scientific and technical progress in the majority of sectors is slack, as a matter of fact, proceeding at the rate of evolution. This assessment can also be applied to robot design. The scientists, designers and mechanical engineers are confronted with the task of achieving revolutionary advances: conversion to fundamentally new technological systems and modern engineering to provide the greatest effectiveness. Such revolutionary advances cannot be achieved in automation if the main effort is devoted simply to replacing certain manual operations of man in the performance of secondary processes with minimal modernization of technology.

Regrettably, such an alarming tendency can be seen not only in robotization, but also in the development of the prototypes of flexible automated manufacturing systems, where the entire force of modern electronics, computer technology and instrumentation is directed at achieving "elimination of humans" from secondary operations, transport and loading of products, and the feeding and changing of tools. But the industrial processes remain at the same level as prior to automation. Meanwhile, a major acceleration of the scientific-technical progress and maximum efficiency are impossible without fundamentally new technological systems that combine new machining methods and strategies and a time concentration of operations.

The general trend of automation should be to develop such high-intensity industrial processes and high-production equipment that are simply beyond the capacity of manual operations. Industrial robots must be introduced not where they can assist, but primarily where they are indispensable. This requires an intense plan of development of "technological robot design" with clear allocation of tasks, responsible executives, and time schedules, revising the current comprehensive goal programs of robotization in accordance with this. There should be a reorientation of the specialized organizations from piecewise production of industrial robots to development of complete machine and appliance systems--robotized complexes--with an evaluation of the operations in terms of the end results from the consumer. The planning of any robotization measures should carefully analyze how they will affect the quality of the final production, the equipment productivity on the scale of the total process sector and the overall work force at the particular sector.

Industrial robots today are on the point of blossoming. And it would be unpardonable to not exploit the possibilities that they offer.

12717

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## ROBOTICS

### PROBLEMS WITH INTEGRATING ROBOTS IN CONVENTIONAL PRODUCTION

Moscow MOSKOVSKAYA PRAVDA in Russian 15 Nov 84 p 2

[Interview with Ivan Vasilyevich Vorotyntsev, director of a grid and boring machine plant, by V. Sedov of Moscow MOSKOVSKAYA PRAVDA: "The Robot Will Help Us"; date and place not specified]

[Text] We are talking with Ivan Vasilyevich Vorotyntsev, candidate of economic sciences and director of a grid and boring machine plant. The enterprise that he heads is involved in precision machine-tool engineering. Its basic products--grid boring and thread grinding machines--are exported to more than 50 countries, including such technically highly developed ones as Japan, the USA and FRG. In the last three years, production at the plant has increased by 27 percent, and labor productivity by 20 percent. Of course, there are a number of reasons for such success, in particular the high technical level of production and the development of robotics.

[Question] Ivan Vasilyevich, how did you start introducing robotics?

[Answer] Let's begin by agreeing on terminology. What is a robot? By itself it is only one necessary element that is part of a complex consisting of a machine with NPC [numerical program control], a robot and loading device, and a supply of semi-finished stock.

A great deal is being said about robots today. The assistance of these mechanical workers is unquestionably of extraordinary importance. Nonetheless, every enterprise has its own production requirements, its own work conditions. It is with this in mind that the typical, as well as less common, problems of incorporating this technology must be solved. Our production is on a small scale (we produce high precision machines). This explains the size of our parts list. We process up to 20,000 separate parts annually, and the resulting frequent equipment resettings unfavorably affect our use of robots.

It is well known that there is a shortage of workers, particularly machine-tool operators. This is why manipulators must compensate for the manpower shortage when there is heavy, monotonous manual labor to be done. For this purpose it is necessary to select correctly and accurately the nomenclature of parts to be processed by robotics complexes, in order to reduce the number of resettings.

[Question] You have determined where to install robots. But how do you execute your plans?

[Answer] We ourselves do not work out the designs of robots. There are scientific research institutes for that purpose. The industry offers us certain types of robots. Not robotics complexes, I should emphasize, but robots. Thus, it is necessary to weigh everything carefully many times before purchasing them. Otherwise, it might happen that one likes a particular robot and buys it. After using it awhile, it becomes clear that it's the wrong one. The money has been wasted. And it is not cheap--over 33,000 rubles. One must have a clear picture of exactly what operation a mechanical assistant is going to perform and where it will be best placed. Here the advice of shop leaders and workers is invaluable.

[Question] What has already been done at the plant in the area of integrating robots?

[Answer] We now have two robotics complexes in operation. The first we introduced a year ago, based on a NPC lathe. It is able to handle large loads and monotony of movements, after all, it was designed for this. It doesn't even need to rest. The robot works with unvarying high productivity. It is intended for handling round, cylindrical shaft-type parts. The iron assistant is equipped with two mechanical arms. The left arm picks up the semi-finished stock, while the right arm puts a finished part in place. Introducing this complex allows us to free one worker and will save about 5,000 rubles per year.

[Question] You said that the economic effect of introducing the robotics complex is about 5,000 rubles a year, while the robot itself runs 33,000 rubles. Is such a discrepancy between cost and results justifiable?

[Answer] One can certainly not talk only about the "bare" economic effect of introducing robots, although that effect is significant. For example, they used to handle shaft-type parts in the stock shop on a NPC lathe. One worker was unable to operate two lathes; he could cope with just one and a great deal of time was lost. Here we installed a loading robot. It is able to handle everything. As a result, the entire parts-processing cycle has been automated. Labor productivity has tripled.

A social effect has come about as well, which is of no little importance. A modern worker should not have to manually lift and place large, heavy stock onto a lathe. Mechanizing and automating such processes means not only saving time, but freeing a person from monotony.

We have three articulated balance manipulators working in "loading and unloading". They assist workers in placing shafts and feed screws onto the lathe for machining. These screws weigh up to 120 kilograms each. Three men used to lift one of them, using a crane. This took a lot of time. Now one worker can handle it much faster. Here the manipulators have helped save about 12,000 rubles a year. But one must be very careful when dealing with numbers. It takes one hour to machine a feed screw. Placing the part on the lathe takes only one minute. Eight hours--eight screws and... each manipulator works eight

minutes. It might seem that there is no benefit to this. We have, however, established a benefit, because, I repeat, the main thing is to free the worker from heavy physical labor. But there is yet another advantage: the establishing of related technology. It spurs people on to further professional development. We have a young lathe operator, Sergei Strichko. When he learned that the plant was acquiring NPC lathes for machining, he requested permission to familiarize himself with the equipment. After studying the lathe through documents, he worked with the setting-up crew to integrate it into the shop. And now he is creating programs for the lathe on his own.

There are currently 33 NPC lathes in operation at the plant. Because of the installation of automated manipulators and industrial robots, 89 people have been conditionally freed from manual labor since the beginning of the 11th Five-Year Plan. And this means that we are using people replaced by the equipment in areas where they are more needed.

[Question] What are the plant's plans for integrating robotics, say, for the next five years?

[Answer] It has been decided to develop and introduce a complex project for re-equipping the plant. This provides for organizing automated production of preparatory, semi-finished and finished machining of parts. A project has been approved for robotization of the plant by 1990. We are planning to introduce 13 robots in the mechanical and galvanic shops, and in the thermal section, that is, in the most labor-consuming sections. Executing this program will enable us to free 120 people from manual labor.

A commission has been created within the party committee to monitor fulfillment of this program.

By the way, we ourselves will be producing during the 11th Five-Year Plan lathes with robotics elements that will part of flexible automated complexes.

[Question] So your present experience with integrating robotics will prove useful in the future as you create improved equipment. This means you are giving special attention to it, and probably placing great stock in the outcome?

[Answer] Of course. But before adding more about robotics itself, I would like to say a few words about the specialists working with it. In Moscow they are trained only at the Moscow Higher Technical Training Institute imeni N. E. Bauman and at the Moscow Institute of Radiotechnology, Electronics and Automation, and only 25 people a year at that. It's true, in 1981 they opened a robotics department at STANKIN [Moscow Institute of Machines and Tools]. It is the first to train specialists strictly for industrial robots. In two years it will graduate 75 engineers. We have only to wait for them. But we need them today. It is a most serious problem and demands an immediate solution. In the meantime we are working on our own.

Now something concrete on the quality of the robots. Their electronic "stuffing" often goes out of order. But there is also a shortage of electronics experts, and again arises the risk of extended downtime.

In addition, as I said at the beginning, we have to create our own robotics complexes. First we purchase a robot, and then try to integrate it with NPC lathes and a loading device. The entire setting-up operation not only takes a great deal of time and effort, but also costs a pretty penny. That is why I emphasize that it would be very desirable to get not just individual robots but whole complexes. They must be more reliable and, of course, more affordable.

[Question] Ivan Vasilyevich, does the problem of psychological compatability of robots and people come up?

[Answer] You know, while installing robotics we encountered a guarded reaction on the part of some shop leaders and workers who had previously never had to deal with such a thing. The first ones were afraid of new problems; there were all sorts of "what if?" questions. Before, everything was simpler and easier to understand. If a lathe went out of order, you fixed it and tried to make up for lost time. A robot cannot "press harder" during an emergency, it always operates at a set rhythm. That is, the robot forces people to tighten up; equipment downtime becomes all the more intolerable.

As concerns the workers, it happened that some of them requested to go back to the old way. They were afraid that the tireless and pedantic robot would cut into their earnings. However, the workers have now become convinced that this is not the case, if only because there is now the possibility of expanding the lathes' service zone. Moreover, it is much more convenient and interesting to operate this assistant than to perform difficult and varied manual operations oneself. The question one hears more and more in the shops is "When are we getting robots?".

12824

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29 October 1985

## BRIEFS

ROBOTS IN THE FACTORY--Tiraspol (Moldavian SSR)--The Tiraspol Foundry Machine Factory has organized the production of flexible automated lines for casting under pressure. All the technological operations of such machines have been placed under the control of automation. The outfitting of the plant with control instruments was made possible by the development of an electronic system department and placement of an electronics shop into service at the factory. Shortly before May the enterprise began to manufacture command units that not only control the equipment, but also diagnose its condition. Today there are around 300 industrial robots and automated machine tools in operation at the Moldavian enterprises. [Text] [Moscow SELSKAYA SHIZN in Russian 30 Apr 85 p 1] 12717

ROBOTS ENTERING THE WORKSHOP--New industrial robot technological complexes replacing the manual labor of the turner, fitter and other metal working specialties have been developed at the main design organization of the Baltic region--the Central Planning and Design Bureau of Mechanization and Automation [TsPKBMA], located at Riga. The Riga complexes "know how" to drill, ream, cut threads and perform other operations heretofore done by highly-skilled workers. In all, the designers have created 9 basic types of standard robot technological complexes and have used these to put together another 69 kinds of special machining complexes for parts of various configurations. The introduction of thread-cutting and boring complexes at a single enterprise of the Union ministry--the Kazan Production Association Teplokontrol--has, for example, replaced 12 workers: machine operators, fitters, and transport workers; and has freed up 10 metal cutting lathes. The annual economic impact from the adoption of the TSPKBMA projects by the enterprise is more than 200,000 rubles. [Text] [Riga SOVETSKAYA MOLODEZH in Russian 7 May 85 p 3] 12717

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